Appendix D

Questionnaires for Actions Recommended in the Draft Habitat Expansion Plan

Habitat Expansion Agreement

for

Central Valley Spring-Run Chinook Salmon and California Central Valley Steelhead

Questionnaire Instructions

The attached questionnaire is intended to solicit information needed by the Steering Committee to review projects relative to the criteria established in the Habitat Expansion Agreement. For each proposed action (project), please complete the questionnaire to the fullest extent possible. Please provide citations where applicable and provide a full reference for each citation at the end of this questionnaire (Section X. Supporting Documents). Specific instructions follow.

I. Contact Information

Provide the name of the agency or group making the proposal as well as a contact person for the project. Include contact information such as mailing address, phone number, and email address.

II. Project Description

Provide a descriptive name for the action (project). If the action is listed in the *Working List of Potential Habitat Expansion Actions* (provided during the January 2009 meetings of HEA parties), please include the reference number associated with the action. The project location should specify the watershed or subwatershed (e.g., Deer Creek, Beegum Creek) as well as specific areas within the watershed where the project will be located and what portions of the watershed will benefit from the project. Please include geographic coordinates of the project location(s), if applicable. The project description should be a narrative that provides as much detail as possible about the project.

III. Species Limiting Factors

In this section, indicate the factors that currently limit production of spring-run Chinook salmon and/or steelhead in your watershed. The intent is that the environmental and biological objectives of your project address these limiting factors in some way. Please check one or more of the limiting factors that apply to your watershed. In the second column, describe how and where the factor limits spring-run Chinook salmon and/or steelhead. For each factor that you check, please rank its effect on spring-run Chinook salmon and/or steelhead using the drop-down box in the last column. Finally, we also ask that you describe the source of your conclusions, such as a watershed assessment or other document. Please provide enough information that we can find the document if we need it.

IV. Project Objectives—Environmental

Environmental objectives describe how the project is intended to address the limiting factors to achieve the biological objective described in the next section. Environmental objectives should be as specific and quantitative as possible (e.g., reduce gravel embeddedness in the watershed from 75% to 25% by fencing riparian areas to exclude cattle and allow riparian forest to reestablish). Describe how you think environmental objectives relate specifically to the biological objectives. In the last column, we ask you to describe the environmental objectives as either the primary or secondary focus of the project. For example, a project to plant trees might have a primary focus on riparian/floodplain function with a secondary focus on temperature or water quality.

V. Project Objectives—Biological

Biological objectives describe the anticipated biological response from the project and should be as quantitative as possible. Indicate which species and life stages are the focus of the project. Describe specifically the general condition of the target species in your watershed relative to the historical abundance. The condition of the species should be indicated using the categories in the drop-down box. Species condition categories are defined on the last page of this form. Biological objectives should include the following information: (1) an estimate of the expected contribution of the project in terms of potential adult returns, to the extent possible (and an explanation of how the estimate was developed); and (2) an explanation of how the biological objective for the species is addressed by the action relative to the environmental limiting factors (e.g., the biological objective of an action might be to increase egg incubation survival in a watershed that is currently limited by sediment levels).

VI. Project Cost

To the extent possible, estimate the capital cost of the project, the annual operating and maintenance (O&M) cost, a description of annual O&M activities, and the project lifetime (i.e., how many years O&M activities are expected, including indefinitely, and how long until you expect the project to provide benefits). Provide any confirmed or potential funding partners, or opportunities for cost sharing with other funders or between projects. Also, identify any confirmed or potential partners that might provide maintenance support for the project (funding support or labor support).

VII. Schedule

Describe the project schedule, including a potential start date, construction period, and environmental and biological response times (i.e., the expected time to realize environmental and biological benefits). The last points refer to the maturation period for the project during which time environmental conditions develop. For example, it may take 50–100 years before full environmental benefits (e.g., shading, channel stability, water quality) of planting riparian trees are realized.

VIII. Feasibility

Describe the feasibility and challenges of the project. Feasibility issues should include primarily technical issues, success of projects utilizing similar technology, and particular challenges posed by the specific project. Other issues of feasibility that may be included are challenges associated with property ownership, permitting, zoning, and other social-economic-legal issues.

IX. Project Support

Describe the support or potential conflicts associated with the project. Specifically, provide supporting and cooperating entities (e.g., agencies, non-governmental organizations). Are there cooperating agencies or groups, aside from the potential funding partners mentioned previously? Describe the degree of local support and any known opposition or conflicts with other parties.

X. Supporting Documents

Provide full references for each citation used to support the information presented in this questionnaire for your project. At a minimum, a reference should include the author(s) name; name of agency/organization (if applicable); title of the document; volume and title of journal, if the document is taken from a professional journal; and publisher, date, and location of publication.

Appendix D1

Questionnaires Received on the Lower Yuba River Actions

Questionnaire

for

Information on Potential Projects to Support Spring-Run Chinook Salmon and Steelhead in the Sacramento River Basin for the Habitat Expansion Agreement

DUE: Friday, February 27, 2009

Send completed questionnaires to hea@water.ca.gov

I. Contact Information

Name:	Gary Reedy
Organization:	South Yuba River Citizens League (SYRCL)
Address:	216 Main Street
City, State, Zip Code:	Nevada City, CA 95959
Phone Number:	(530) 265-5961 ext 208
Email Address:	gary@syrcl.org

II. Project Description

Project Name:	Backwater, Side-channel, and Riparian/Floodplain Habitat Restoration in the lower Yuba River
Reference No. or New:	New
Project Location:	Yuba River downstream of Englebright Dam

Project Description:

At present, a pre-project assessment is being conducted to inform opportunities for juvenile salmonid habitat enhancements (including a pilot riparian revegetation project) at Hammon Bar on the lower Yuba River. The pre-project assessment is addressing the geomorphic, hydrologic, and biotic factors influencing riparian recruitment, growth, and survival in the project area. Current work includes a public outreach component to inform nearby landowners, concerned stakeholders, and watershed groups about the proposed pilot project.

II. Project Description

We want to expand the current work to evaluate conditions along approximately 3 additional river miles of Western Aggregates land recently placed under conservation easement in agreement with SYRCL downstream of Hammon Bar. Using what we learn from the pre-project assessment and pilot project, we intend to implement large-scale restoration in the Yuba River by creating and restoring backwater, side-channel, and riparian/floodplain habitat in the lower Yuba River.

III. Species Limiting Factors

In this section, describe the limiting factors for spring-run Chinook salmon and steelhead in your watershed. The last page of this questionnaire defines the limiting factors.

Limiting Factors	Description (from back page)	Rank
☒ **Channel Form**	The Yuba River in California's Central Valley was severely degraded by hydraulic and dredger mining, primarily from the mid-19th through mid-20th century. In the Yuba Goldfields reach of the Lower Yuba River, dredger tailings confine the river channel along much of its length, and shaded riverine aquatic habitat, riparian habitat, and floodplain inundation are limited. The resulting reduction in aquatic habitat complexity and diversity has been identified as a limiting factor to salmonid populations, and adversely affects rearing salmonids in particular.	High
☐ **Channel Unit Types**		Select Rank
☐ **Substrate**		Select Rank
☒ **Structure**	The Yuba River in California's Central Valley was severely degraded by hydraulic and dredger mining, primarily from the mid-19th through mid-20th century. In the Yuba Goldfields reach of the Lower Yuba River, dredger tailings confine the river channel along much of its length, and shaded riverine aquatic habitat, riparian habitat, and floodplain inundation are limited. The resulting reduction in aquatic habitat complexity and diversity has been identified as a limiting factor to salmonid populations, and adversely affects rearing salmonids in particular.	High
☐ **Flow**		Select Rank
☐ **Temperature**		Select Rank
☐ **Water Quality**		Select Rank
☐ **Passage**		Select Rank
☒ **Riparian/Floodplain**	The Yuba River in California's Central Valley was severely degraded by hydraulic and dredger mining, primarily from the mid-19th through mid-20th century. In the Yuba Goldfields reach of the Lower Yuba River, dredger tailings confine the river channel along much of its length, and shaded riverine aquatic habitat, riparian habitat, and floodplain inundation are limited. The resulting reduction in aquatic habitat complexity and diversity has	High

III. Species Limiting Factors

been identified as a limiting factor to salmonid populations, and adversely affects rearing salmonids in particular.

Source Documents:

CVPIA 10-year Implementation Plan

Additional Notes:

IV. Project Objectives—Environmental

In this section, describe how your project will affect one or more of the limiting factors for spring-run Chinook salmon or steelhead described above.

Limiting Factor	Description and Objective	Focus
☒ **Channel Form**	Create/restore 5 acres of new backwater or side-channel habitat for rearing juvenile salmonids.	Primary
☐ **Channel Unit Types**		Select Focus
☐ **Substrate**		Select Focus
☒ **Structure**	Create/restore 5 acres of new backwater or side-channel habitat for rearing juvenile salmonids, as above. Installation of instream woody material may be used to provide structure.	Primary
☐ **Flow**		Select Focus
☐ **Temperature**		Select Focus
☐ **Water Quality**		Select Focus
☐ **Passage**		Select Focus
☒ **Riparian/Floodplain**	Create/restore 50 acres of new riparian/floodplain habitat for rearing juvenile salmonids.	Primary

V. Project Objectives—Biological

In this section, describe the objective(s) of your project relative to the goal of providing habitat for spring-run Chinook salmon and steelhead. Indicate the species and life stage that are targeted by the project. (It is okay to have more than one species/life stage target).

Target Species: ☒ Spring-Run Chinook Salmon **Population Status Specific to Watershed:** Decreasing

Target Life Stages:

☐ Spawning ☐ Egg Incubation ☒ Summer Rearing ☒ Winter Rearing

☐ Juvenile Emigration ☐ Adult Immigration ☐ Adult Holding

Description of Project Objectives:

Increase habitat complexity (e.g., create/restore backwater and side-channel habitat, physical structure, shaded rivierine aquatic, riparian, and floodplain habitat) to provide for increased growth, protection from predators, and overall increased survival of juvenile salmonids.

Target Species: ☒ Steelhead **Population Status Specific to Watershed:** Decreasing

Target Life Stages:

☐ Spawning ☐ Egg Incubation ☒ Summer Rearing ☒ Winter Rearing

☐ Juvenile Emigration ☐ Adult Immigration

Description of Project Objectives:

Increase habitat complexity (e.g., create/restore backwater and side-channel habitat, physical structure, shaded rivierine aquatic, riparian, and floodplain habitat) to provide for increased growth, protection from predators, and overall increased survival of juvenile salmonids.

VI. Project Cost

Capital Cost:	$2M
Annual Operation and Maintenance Cost:	$20K
Annual Operation and Maintenance Description:	Ongoing gravel/riparian augmentation and instream woody material installation
Project Lifespan:	30 years
Project Partners (Funding):	Corps of Engineers, Western Aggregates, PG&E, USFWS Anadromous Fish Restoration Program
Project Partners (Maintenance):	Corps of Engineers, South Yuba River Citizens League

VII. Schedule

Proposed Start:	2009
Expected Time to Completion:	2019
Expected Time to Realize Environmental Benefits:	2011; full environmental benefits realized in 2019
Expected Time to Realize Biological Benefits:	2011; full environmental benefits realized in 2019

VIII. Feasibility

Technical Feasibility:	Pre-project assessment is underway; pilot project soon to be underway; design plans are needed and permits will need to be obtained.
Technical Challenges:	The Yuba River can be a very active river channel
Related Projects:	Other easements and publically-owned land are likely to become available for habitat restoration projects on the Yuba River.
Ownership or Permitting Challenges:	None
Conflicts with Cultural, Zoning, or Other Issues:	None

IX. Project Support

Supporting Entities:	SYRCL, FWS
Cooperating Entities:	DFG and NMFS
Degree of Local Support:	SYRCL has been conducting outreach activities to inform the public about this project
Known Opposition:	Corps of Engineers commitment to project is unknown.

X. Supporting Documents

Please provide a full reference for each citation used to support the information presented in this questionnaire.

X. Supporting Documents

Definitions of Limiting Factors for Spring-Run Chinook Salmon and Steelhead

Channel Form

This attribute describes changes to the channel, including incision, aggradation, diking, armoring, and other modifications of the channel adversely affecting spring-run Chinook salmon and steelhead.

Channel Unit Types

Examples of geomorphic features of the channel that form habitat types for spring-run Chinook salmon and steelhead are pools, riffles, glides, and runs. This attribute describes changes in the frequency and size of such features. For example, removal of large wood may reduce the frequency of pools, presence of steps, or retention of gravel for riffles.

Substrate

This attribute describes changes in the composition of the substrate of the stream, including increase in fine sediment and lack of gravel recruitment.

Structure

This attribute describes the loss of structural elements in the stream such as large wood, boulders, undercut banks, and so on. Loss of structure results in a simplification of the channel and influences Channel Form and Channel Unit Types.

Flow

This attribute addresses modification of the flow regime, including decrease in summer low flow, increased "flashiness," and dewatering of the channel as a result of withdrawals.

Temperature

Change in water temperature can be attributable to human actions such as removal of riparian shading. This attribute describes the increase in summer water temperature and the loss of temperature refugia (springs or groundwater) as a result of human actions.

Water Quality

This attribute pertains to the input to the stream of toxins or pollutants that produce adverse impacts on spring-run Chinook salmon or steelhead. This can include chemical pollutants such as fertilizer and pesticides and nutrient sources such as cattle and feedlots.

Passage

This relates to the effect of impediments to adult or juvenile migration of spring-run Chinook salmon or steelhead, including dams, culverts, channel dewatering, and other structural and channel modifications. Please describe the location of the passage impediment and describe the extent of impediment (i.e., a complete or partial blockage to migration).

Riparian/Floodplain

This attribute describes the loss of functionality of the riparian forest/vegetation and the connection of the stream to the floodplain during high water and flooding.

Population Condition Definitions for Section V. Project Objectives—Biological

Increasing

Adult returns of the target species to the watershed have generally been increasing over the last several years; expectations are that the species is displaying characteristics of a rebuilding or healthy population.

Stable

Adult returns of the target species to the watershed show no clear trend over the last several years.

Decreasing

Adult returns of the target species to the watershed are declining over the last several years; the decline in abundance is a cause of concern and characteristic of a potentially unhealthy population.

Intermittent

Adult returns of the target species are occasionally seen in the watershed, but there is no viable or sustained population in the basin.

Extirpated

The population has been eliminated from the watershed although the species was present in the past.

Never Present

The species has never been known to occur in the watershed.

Questionnaire

for

Information on Potential Projects to Support Spring-Run Chinook Salmon and Steelhead in the Sacramento River Basin for the Habitat Expansion Agreement

DUE: Friday, February 27, 2009

Send completed questionnaires to hea@water.ca.gov

I. Contact Information

Name:	Gary Reedy
Organization:	South Yuba River Citizens League (SYRCL)
Address:	216 Main Street
City, State, Zip Code:	Nevada City, CA 95959
Phone Number:	(530) 265-5961 ext 208
Email Address:	gary@syrcl.org

II. Project Description

Project Name:	Backwater, Side-channel, and Riparian/Floodplain Habitat Restoration in the lower Yuba River
Reference No. or New:	New (same as submitted by FWS)
Project Location:	Lower Yuba River in the reach from the Hwy 20 bridge down to above Daguerre Point Dam.

Project Description:

Rearing habitat for spring-run Chinook and steelhead in the Lower Yuba River is limited by a lack of habitat diversity and complexity owing to channel changes associated with past dredger mining activities. This project addresses the upper portion of the Yuba Goldfields where these habitat limitations are most conspicuous and the opportunities for restoration greatest. The project will build on a current AFRP-funded pilot restoration project and a conservation easement on Western Aggregates land to design and implement restoration of new functional

II. Project Description

floodplain habitat, off-channel rearing habitat (backwaters and side-channels), large wood structure and enhanced riparian. Habitat enhancemnets will be designed to maximize extended rearing of juvenile spring-run Chinook and steelhead. The full-phase project will require excavation of dredger material suitable in both volume and quality for use by the Army Corps of Engineers in their gravel augmentation program below Englebright Dam. Thus, this project compliments the Narrows Spawning Habitat Rehabilitation project in two ways: provision of maintenance gravels and enhanced rearing habitat for expanded populations of salmon and steelhead.

III. Species Limiting Factors

In this section, describe the limiting factors for spring-run Chinook salmon and steelhead in your watershed. The last page of this questionnaire defines the limiting factors.

Limiting Factors	Description (from back page)	Rank
☒ **Channel Form**	The lower Yuba River is artifically straightened and narrowed due to the management of hydraulic mining debris and dredger mining activity.	High
☐ **Channel Unit Types**		Select Rank
☐ **Substrate**		Select Rank
☒ **Structure**	Large wood and riparian is conspicuously lacking in the Lower Yuba River. The technical team of fish biologists developing the Yuba Accord Fisheries Agreement identified lack of habitat complexity and diversity as one of four top stressors on Yuba River salmonid populations. This stressor is particularly important for spring-run and steelhead whose life history involves extended rearing.	High
☐ **Flow**		Select Rank
☐ **Temperature**		Select Rank
☐ **Water Quality**		Select Rank
☐ **Passage**		Select Rank
☒ **Riparian/Floodplain**	Due to artificial channel confinement and a lack of riparian vegetation, populations of rearing juvenile salmonids are limited in their ability to rear past spring flows and grow at high rates.	High

Source Documents:

Draft Implementation Plan for Lower Yuba River Fisheries Habitat Restoration, CVPIA 10-year Implementation Plan

Additional Notes:

The Yuba Accord provides flow schedules and temperature management which promises to minimize or adaptively manage the other top stressors identified for salmon and steelhead. In addition, the River Management Team is spending $0.5M annually in monitoring salmonid populations and habitat in a way that could provide evaluation for the proposed project.

IV. Project Objectives—Environmental

In this section, describe how your project will affect one or more of the limiting factors for spring-run Chinook salmon or steelhead described above.

Limiting Factor	Description and Objective	Focus
☒ **Channel Form**	Create/restore a minimum of 5 acres of new backwater or side-channel habitat for rearing juvenile salmonids.	Primary
☐ **Channel Unit Types**		Select Focus
☐ **Substrate**		Select Focus
☒ **Structure**	Install woody instream material and boulders within newly created backwater or side-channel habitat and at other locations in reach..	Primary
☐ **Flow**		Select Focus
☐ **Temperature**		Select Focus
☐ **Water Quality**		Select Focus
☐ **Passage**		Select Focus
☒ **Riparian/Floodplain**	Create/restore 50 acres of new functional floodplain with enhanced riparian habitat for rearing juvenile salmonids.	Primary

V. Project Objectives—Biological

In this section, describe the objective(s) of your project relative to the goal of providing habitat for spring-run Chinook salmon and steelhead. Indicate the species and life stage that are targeted by the project. (It is okay to have more than one species/life stage target).

Target Species: ☒ Spring-Run Chinook Salmon **Population Status Specific to Watershed:** Decreasing

Target Life Stages:

☐ Spawning ☐ Egg Incubation ☒ Summer Rearing ☒ Winter Rearing

☐ Juvenile Emigration ☐ Adult Immigration ☐ Adult Holding

Description of Project Objectives:

Enhance rearing habitat by constructing backwater and side-channels, placing wood, planting riparian and engineering restored functional floodplains. High quality rearing habitat will provide for increased growth, protection from predators, and overall increased survival of juvenile salmonids.

V. Project Objectives—Biological

Target Species: ☒ Steelhead

Population Status Specific to Watershed: Decreasing

Target Life Stages:

☐ Spawning ☐ Egg Incubation ☒ Summer Rearing ☒ Winter Rearing

☐ Juvenile Emigration ☐ Adult Immigration

Description of Project Objectives:

Enhance rearing habitat by constructing backwater and side-channels, placing wood, planting riparian and engineering restored functional floodplains. High quality rearing habitat will provide for increased growth, protection from predators, and overall increased survival of juvenile salmonids.

VI. Project Cost

Capital Cost:	$2M
Annual Operation and Maintenance Cost:	$30K
Annual Operation and Maintenance Description:	Riparian enhancement and monitoring will be the primary maintenance cost to the project. The Corps is required to implement by 2012 a program of large wood supply to the lower Yuba River (NMFS 2007)
Project Lifespan:	30 years
Project Partners (Funding):	Corps of Engineers, Western Aggregates, BLM, PG&E, USFWS Anadromous Fish Restoration Program
Project Partners (Maintenance):	Corps of Engineers, South Yuba River Citizens League

VII. Schedule

Proposed Start:	2009
Expected Time to Completion:	2019
Expected Time to Realize Environmental Benefits:	2011; full environmental benefits realized in 2019
Expected Time to Realize Biological Benefits:	2011; full environmental benefits realized in 2019

VIII. Feasibility

Technical Feasibility:	Pre-project assessment is underway, and conceptual designs available. Design plans alternatives and permits will need to be obtained. This type of restoration has occurred on other large Central Valley rivers.
Technical Challenges:	The Yuba River is an active channel with limitied flood management. The factors limiting recruitment and survival of riparian are still undergoing local investigation and unnatural summer hydrographs may prove problematic.
Related Projects:	Other easements and publically-owned land are likely to become available for habitat restoration projects on the Yuba River. This project compliments the Yuba Narrows Rehabilitation project by addressing limiting factors for juvenile rearing and providing a source for the maintenance of gravels.
Ownership or Permitting Challenges:	Western Aggregates has made 3 miles of the south bank a conservation easement for the purpose of habitat restoration. BLM manages the Hammon tract and is an cooperative partner. A small tract of Army Corps land exists between. Corps permits will be needed.
Conflicts with Cultural, Zoning, or Other Issues:	None determined

IX. Project Support

Supporting Entities:	SYRCL, FWS, BLM, Western Aggregates
Cooperating Entities:	DFG and NMFS
Degree of Local Support:	SYRCL has been conducting outreach activities to inform the public about this project and encountered a high degree of support
Known Opposition:	None determined.

X. Supporting Documents

Please provide a full reference for each citation used to support the information presented in this questionnaire.

SYRCL (2008) A Framework for Restoration in the Lower Yuba River

Draft Implementation Plan for Lower Yuba River Anadromous Fish Habitat Restoration. October 2005. Lower Yuba River Fisheries Technical Working Group. CD Distribution

NMFS BiOp on Englebright and Daguerre Dams (2007)

Definitions of Limiting Factors for Spring-Run Chinook Salmon and Steelhead

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Channel Unit Types

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Substrate

This attribute describes changes in the composition of the substrate of the stream, including increase in fine sediment and lack of gravel recruitment.

Structure

This attribute describes the loss of structural elements in the stream such as large wood, boulders, undercut banks, and so on. Loss of structure results in a simplification of the channel and influences Channel Form and Channel Unit Types.

Flow

This attribute addresses modification of the flow regime, including decrease in summer low flow, increased "flashiness," and dewatering of the channel as a result of withdrawals.

Temperature

Change in water temperature can be attributable to human actions such as removal of riparian shading. This attribute describes the increase in summer water temperature and the loss of temperature refugia (springs or groundwater) as a result of human actions.

Water Quality

This attribute pertains to the input to the stream of toxins or pollutants that produce adverse impacts on spring-run Chinook salmon or steelhead. This can include chemical pollutants such as fertilizer and pesticides and nutrient sources such as cattle and feedlots.

Passage

This relates to the effect of impediments to adult or juvenile migration of spring-run Chinook salmon or steelhead, including dams, culverts, channel dewatering, and other structural and channel modifications. Please describe the location of the passage impediment and describe the extent of impediment (i.e., a complete or partial blockage to migration).

Riparian/Floodplain

This attribute describes the loss of functionality of the riparian forest/vegetation and the connection of the stream to the floodplain during high water and flooding.

Population Condition Definitions for Section V. Project Objectives—Biological

Increasing

Adult returns of the target species to the watershed have generally been increasing over the last several years; expectations are that the species is displaying characteristics of a rebuilding or healthy population.

Stable

Adult returns of the target species to the watershed show no clear trend over the last several years.

Decreasing

Adult returns of the target species to the watershed are declining over the last several years; the decline in abundance is a cause of concern and characteristic of a potentially unhealthy population.

Intermittent

Adult returns of the target species are occasionally seen in the watershed, but there is no viable or sustained population in the basin.

Extirpated

The population has been eliminated from the watershed although the species was present in the past.

Never Present

The species has never been known to occur in the watershed.

Questionnaire

for

Information on Potential Projects to Support Spring-Run Chinook Salmon and Steelhead in the Sacramento River Basin for the Habitat Expansion Agreement

DUE: Friday, February 27, 2009

Send completed questionnaires to hea@water.ca.gov

I. Contact Information

Name:	Beth Campbell
Organization:	USFWS
Address:	Stockton FWO
	4001 North Wilson Way
City, State, Zip Code:	Stockton, CA 95205
Phone Number:	(209) 334-2968 ext 402
Email Address:	elizabeth_campbell@fws.gov

II. Project Description

Project Name:	Yuba River Narrows Habitat Enhancement
Reference No. or New:	New
Project Location:	Yuba River (Narrows Reach is about 10 miles upstream from Daguerre Point Dam)

Project Description:

Spawning gravel is abundant in much of the lower Yuba River due to continual inputs from historical mine tailings. In the Narrows reach where spring-run Chinook salmon hold, however, gravel augmentation is needed. Spring-run chinook salmon in fact have been observed attempting to spawn on bedrock. This project would provide for the removal of undesirable "shot rock" and install spawning gravel usable by spring-run Chinook salmon and steelhead.

III. Species Limiting Factors

In this section, describe the limiting factors for spring-run Chinook salmon and steelhead in your watershed. The last page of this questionnaire defines the limiting factors.

Limiting Factors	Description (from back page)	Rank
☐ **Channel Form**		Select Rank
☐ **Channel Unit Types**		Select Rank
☒ **Substrate**	Insufficent gravel for spawning is available in the Narrows reach of the Yuba River where many spring-run Chinook salmon hold and attempt to spawn.	High
☐ **Structure**		Select Rank
☐ **Flow**		Select Rank
☐ **Temperature**		Select Rank
☐ **Water Quality**		Select Rank
☐ **Passage**		Select Rank
☐ **Riparian/Floodplain**		Select Rank

Source Documents:

CVPIA 10-year Implementation Plan

Additional Notes:

IV. Project Objectives—Environmental

In this section, describe how your project will affect one or more of the limiting factors for spring-run Chinook salmon or steelhead described above.

Limiting Factor	Description and Objective	Focus
☐ **Channel Form**		Select Focus
☐ **Channel Unit Types**		Select Focus
☒ **Substrate**	Restore 1 acre of salmonid spawning habitat in the Narrows reach of the Yuba River.	Primary
☐ **Structure**		Select Focus
☐ **Flow**		Select Focus
☐ **Temperature**		Select Focus
☐ **Water Quality**		Select Focus
☐ **Passage**		Select Focus

IV. Project Objectives—Environmental

☐ **Riparian/Floodplain** Select Focus

V. Project Objectives—Biological

In this section, describe the objective(s) of your project relative to the goal of providing habitat for spring-run Chinook salmon and steelhead. Indicate the species and life stage that are targeted by the project. (It is okay to have more than one species/life stage target).

Target Species: ☒ Spring-Run Chinook Salmon **Population Status Specific to Watershed:** Decreasing

Target Life Stages:

☒ Spawning ☐ Egg Incubation ☐ Summer Rearing ☐ Winter Rearing

☐ Juvenile Emigration ☐ Adult Immigration ☐ Adult Holding

Description of Project Objectives:

Increase the availability of suitable spawning habitat in the Narrows reach of the Yuba River, to provide for increased spawning success of spring-run Chinook salmon.

Target Species: ☒ Steelhead **Population Status Specific to Watershed:** Decreasing

Target Life Stages:

☒ Spawning ☐ Egg Incubation ☐ Summer Rearing ☐ Winter Rearing

☐ Juvenile Emigration ☐ Adult Immigration

Description of Project Objectives:

Increase the availability of suitable spawning habitat in the Narrows reach of the Yuba River, to provide for increased spawning success of steelhead.

VI. Project Cost

Capital Cost:	$300K
Annual Operation and Maintenance Cost:	$30K
Annual Operation and Maintenance Description:	Ongoing gravel augmentation.
Project Lifespan:	30 years
Project Partners (Funding):	Corps of Engineers, PG&E
Project Partners	Corps of Engineers

VI. Project Cost

(Maintenance):

VII. Schedule

Proposed Start:	2010
Expected Time to Completion:	2012
Expected Time to Realize Environmental Benefits:	2012
Expected Time to Realize Biological Benefits:	2012

VIII. Feasibility

Technical Feasibility:	Design plans are needed and permits will need to be obtained.
Technical Challenges:	The Yuba River can be a very active river channel
Related Projects:	The Corps of Engineers is required to do this as part of the NMFS (2002) BO. The Corps funding requirement should be clearly identified, before being supplemented with HEA funds.
Ownership or Permitting Challenges:	Easiest access to a likely site (PG&E mitigation land) is across private land, and landowner support has been inconsistent. DFG is not a proponent of allowing heavy equipment into the stream channel.
Conflicts with Cultural, Zoning, or Other Issues:	None

IX. Project Support

Supporting Entities:	FWS and NMFS
Cooperating Entities:	DFG
Degree of Local Support:	Yuba County Resource Conservation District is a proponent of this project.
Known Opposition:	See ownership or permitting challenges, above.

X. Supporting Documents

Please provide a full reference for each citation used to support the information presented in this questionnaire.

Definitions of Limiting Factors for Spring-Run Chinook Salmon and Steelhead

Channel Form

This attribute describes changes to the channel, including incision, aggradation, diking, armoring, and other modifications of the channel adversely affecting spring-run Chinook salmon and steelhead.

Channel Unit Types

Examples of geomorphic features of the channel that form habitat types for spring-run Chinook salmon and steelhead are pools, riffles, glides, and runs. This attribute describes changes in the frequency and size of such features. For example, removal of large wood may reduce the frequency of pools, presence of steps, or retention of gravel for riffles.

Substrate

This attribute describes changes in the composition of the substrate of the stream, including increase in fine sediment and lack of gravel recruitment.

Structure

This attribute describes the loss of structural elements in the stream such as large wood, boulders, undercut banks, and so on. Loss of structure results in a simplification of the channel and influences Channel Form and Channel Unit Types.

Flow

This attribute addresses modification of the flow regime, including decrease in summer low flow, increased "flashiness," and dewatering of the channel as a result of withdrawals.

Temperature

Change in water temperature can be attributable to human actions such as removal of riparian shading. This attribute describes the increase in summer water temperature and the loss of temperature refugia (springs or groundwater) as a result of human actions.

Water Quality

This attribute pertains to the input to the stream of toxins or pollutants that produce adverse impacts on spring-run Chinook salmon or steelhead. This can include chemical pollutants such as fertilizer and pesticides and nutrient sources such as cattle and feedlots.

Passage

This relates to the effect of impediments to adult or juvenile migration of spring-run Chinook salmon or steelhead, including dams, culverts, channel dewatering, and other structural and channel modifications. Please describe the location of the passage impediment and describe the extent of impediment (i.e., a complete or partial blockage to migration).

Riparian/Floodplain

This attribute describes the loss of functionality of the riparian forest/vegetation and the connection of the stream to the floodplain during high water and flooding.

Population Condition Definitions for Section V. Project Objectives—Biological

Increasing

Adult returns of the target species to the watershed have generally been increasing over the last several years; expectations are that the species is displaying characteristics of a rebuilding or healthy population.

Stable

Adult returns of the target species to the watershed show no clear trend over the last several years.

Decreasing

Adult returns of the target species to the watershed are declining over the last several years; the decline in abundance is a cause of concern and characteristic of a potentially unhealthy population.

Intermittent

Adult returns of the target species are occasionally seen in the watershed, but there is no viable or sustained population in the basin.

Extirpated

The population has been eliminated from the watershed although the species was present in the past.

Never Present

The species has never been known to occur in the watershed.

Questionnaire

for

Information on Potential Projects to Support Spring-Run Chinook Salmon and Steelhead in the Sacramento River Basin for the Habitat Expansion Agreement

DUE: Thursday, April 30, 2009

Send completed questionnaires to hea@water.ca.gov

I. Contact Information

Name:	Duane Massa
Organization:	CA. Dept. of Fish and Game
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Phone Number:	(530) 895-5005
Email Address:	dmassa@dfg.ca.gov

II. Project Description

Project Name:	Lower Yuba River Narrows Gravel Rehabilitation Project
Reference No. or New:	
Project Location:	The Narrows reach is an approximately a six-mile span of potentially high quality spring-run Chinook salmon spawning habitat located on the lower Yuba River from Englebright Dam to the State Route 20 Bridge in Yuba County, CA.

Project Description:

Englebright Dam was constructed in 1941 on the lower Yuba River to trap hyrdaulic mining debris left from the gold rush in California. The dam has been blocking the natural recruitment of spawning gravels in the Narrows reach for over 65 years. In many areas of this reach, the spawning gravels are completely absent and have been replaced by a bedrock substrate. Spring-run Chinook salmon have been observed to migrate and hold in this area of river, but spawning success has been largely impacted by a lack of suitable spawning substrate as a result of gravel impoundment at Englebright Dam. Gravel injection at this site is expected to expand available spawning habitat primarily for spring-run Chinook salmon, as suitable flow regimes already exist. A pilot gravel injection project

II. Project Description

was successfully completed in the Narrows reach during November 2007. Approximately 361 cubic yards of spawning gravels were injected below the Narrows II powerhouse. Aerial redd surveys conducted in 2008 positively identified spring-run Chinook salmon utilizing the pockets of gravel created by this pilot project. However, additional gravels are needed to fully rehabilitate this reach. This can be accomplished through the injection of approximately 54,000 cubic yards of gravel in the Narrows reach (Englebright-SR20) over several years. Preliminary estimates of this river section indicate that this activity can provide additional spawning habitat for over 4,850 spring-run Chinook salmon.

III. Species Limiting Factors

In this section, describe the limiting factors for spring-run Chinook salmon and steelhead in your watershed. The last page of this questionnaire defines the limiting factors.

Limiting Factors	Description (from back page)	Rank
☒ **Channel Form**	Channel incision and slope have been affected by land use, hydraulic mining and hydropower practices.	High
☒ **Channel Unit Types**	Natural channel morphological units have been altered by land use, hydraulic mining and hydropower practices.	High
☒ **Substrate**	Spawning gravel substrate has been completely lost in many sections of the lower Yuba River due to impoundment by Englebright Dam.	Critical
☒ **Structure**	Natural channel form and unit types synonomous with spawning habitat values (i.e. pool, riffle, bank structure, LWD retention, etc.) have been altered by land use, hydraulic mining and hydropower practices.	High
☐ **Flow**		Select Rank
☐ **Temperature**		Select Rank
☐ **Water Quality**		Select Rank
☒ **Passage**	Englebright Dam blocks access to the majority of historic spring-run Chinook salmon spawning habitat. Daguerre Point Dam creates passage difficulties for both adult and juvenile salmonids.	High
☐ **Riparian/Floodplain**		Select Rank

Source Documents:

Pasternack, Greg. 2009. SHIRA-based river analysis and field-based manipulative sediment transport experiments to balance habitat and geomorphic goals on the lower Yuba River. Final Report. U.C. Davis Cooperative Ecosystems Studies Unit

Available from http://pasternack.ucdavis.edu/LYR3_Pasternack_FINAL.pdf

Additional Notes:

III. Species Limiting Factors

IV. Project Objectives—Environmental

In this section, describe how your project will affect one or more of the limiting factors for spring-run Chinook salmon or steelhead described above.

Limiting Factor	Description and Objective	Focus
☒ **Channel Form**	Gravel injection will decrease channel incision and restore natural slope, thus serving to self-regulate additional gravel loss.	Secondary
☒ **Channel Unit Types**	Gravel injection will improve spawning habitat by restoring natual channel morphological units.	Secondary
☒ **Substrate**	Gravel injection will restore natural spawning substrate absent in this reach.	Primary
☒ **Structure**	Gravel injection will restore natural channel form and unit types synonomous with spawning habitat values (i.e. pool, riffle, bank structure, LWD retention, etc.).	Primary
☐ **Flow**		Select Focus
☐ **Temperature**		Select Focus
☐ **Water Quality**		Select Focus
☐ **Passage**		Select Focus
☐ **Riparian/Floodplain**		Select Focus

V. Project Objectives—Biological

In this section, describe the objective(s) of your project relative to the goal of providing habitat for spring-run Chinook salmon and steelhead. Indicate the species and life stage that are targeted by the project. (It is okay to have more than one species/life stage target).

Target Species: ☒ Spring-Run Chinook Salmon **Population Status Specific to Watershed:** Stable

Target Life Stages:

☒ Spawning ☒ Egg Incubation ☒ Summer Rearing ☒ Winter Rearing

☐ Juvenile Emigration ☐ Adult Immigration ☒ Adult Holding

Description of Project Objectives:

The objective of this project is to restore gravel recruitment below Englebright Dam. This process is a critical step to restoring historic spring-run Chinook salmon populations on the lower Yuba River. Gravel injection will serve to restore historic spawning areas currently under-utilized. This process will also serve to restore several other natural river channel unit, form and structural functions; including a reduction of channel incision, restoration of natural

V. Project Objectives—Biological

slope for gravel retention, and restoration of natural pool/run/riffle mesohabitat interactions.

Target Species: ☒ Steelhead

Population Status Specific to Watershed: Stable

Target Life Stages:

☒ Spawning ☒ Egg Incubation ☒ Summer Rearing ☒ Winter Rearing

☐ Juvenile Emigration ☐ Adult Immigration

Description of Project Objectives:

Steelhead escapement to the lower Yuba River is currently unknown, but monitoring activities have observed adult and juvenile steelhead to be present. Adult spawning activity and yearly emigrations have been observed. Restoration of historic spawning areas will likely improve habitat conditions for this species.

VI. Project Cost

Capital Cost:	$3,000,000 (estimated) for initial 54,000 cu yards
Annual Operation and Maintenance Cost:	Unknown
Annual Operation and Maintenance Description:	Annual replentishment of gravel substrate will be necessary for the period that Englebright Dam blocks natural downstream gravel movement.
Project Lifespan:	The project would have a lifespan corresponding with the continued operation of Englebright Dam.
Project Partners (Funding):	Unknown
Project Partners (Maintenance):	Unknown

VII. Schedule

Proposed Start:	Once permits and funding are secured (possibly November 2009).
Expected Time to Completion:	One month
Expected Time to Realize Environmental Benefits:	Immediate
Expected Time to Realize Biological Benefits:	Immediate

VIII. Feasibility

Technical Feasibility:	A pilot gravel injection project was successfully completed in November 2007.
Technical Challenges:	None. All were addressed during pilot project activities.
Related Projects:	A number of restoration projects are in various stages of completion to address passage, spawning and rearing components of a complete river rehabilitation.
Ownership or Permitting Challenges:	The property is owned jointly by PGE, YCWA and USACE. Permits were successfully acquired for the pilot project. No significant challenges forseen.
Conflicts with Cultural, Zoning, or Other Issues:	None identified at this time.

IX. Project Support

Supporting Entities:	U.C. Davis, NMFS, USFWS, USACE, CDFG, PGEYCWA, Yuba River Accord Management Team, Yuba River Technical Working Group, South Yuba River Citizens League
Cooperating Entities:	U.C. Davis, NMFS, USFWS, USACE, CDFG, PGE, YCWA
Degree of Local Support:	High at this time.
Known Opposition:	None identified at this time.

X. Supporting Documents

Please provide a full reference for each citation used to support the information presented in this questionnaire.

Pasternack, Greg. 2009. SHIRA-based river analysis and field-based manipulative sediment transport experiments to balance habitat and geomorphic goals on the lower Yuba River. Final Report. U.C. Davis Cooperative Ecosystems Studies Unit

Available from http://pasternack.ucdavis.edu/LYR3_Pasternack_FINAL.pdf.

Definitions of Limiting Factors for Spring-Run Chinook Salmon and Steelhead

Channel Form

This attribute describes changes to the channel, including incision, aggradation, diking, armoring, and other modifications of the channel adversely affecting spring-run Chinook salmon and steelhead.

Channel Unit Types

Examples of geomorphic features of the channel that form habitat types for spring-run Chinook salmon and steelhead are pools, riffles, glides, and runs. This attribute describes changes in the frequency and size of such features. For example, removal of large wood may reduce the frequency of pools, presence of steps, or retention of gravel for riffles.

Substrate

This attribute describes changes in the composition of the substrate of the stream, including increase in fine sediment and lack of gravel recruitment.

Structure

This attribute describes the loss of structural elements in the stream such as large wood, boulders, undercut banks, and so on. Loss of structure results in a simplification of the channel and influences Channel Form and Channel Unit Types.

Flow

This attribute addresses modification of the flow regime, including decrease in summer low flow, increased "flashiness," and dewatering of the channel as a result of withdrawals.

Temperature

Change in water temperature can be attributable to human actions such as removal of riparian shading. This attribute describes the increase in summer water temperature and the loss of temperature refugia (springs or groundwater) as a result of human actions.

Water Quality

This attribute pertains to the input to the stream of toxins or pollutants that produce adverse impacts on spring-run Chinook salmon or steelhead. This can include chemical pollutants such as fertilizer and pesticides and nutrient sources such as cattle and feedlots.

Passage

This relates to the effect of impediments to adult or juvenile migration of spring-run Chinook salmon or steelhead, including dams, culverts, channel dewatering, and other structural and channel modifications. Please describe the location of the passage impediment and describe the extent of impediment (i.e., a complete or partial blockage to migration).

Riparian/Floodplain

This attribute describes the loss of functionality of the riparian forest/vegetation and the connection of the stream to the floodplain during high water and flooding.

Population Condition Definitions for Section V. Project Objectives—Biological

Increasing

Adult returns of the target species to the watershed have generally been increasing over the last several years; expectations are that the species is displaying characteristics of a rebuilding or healthy population.

Stable

Adult returns of the target species to the watershed show no clear trend over the last several years.

Decreasing

Adult returns of the target species to the watershed are declining over the last several years; the decline in abundance is a cause of concern and characteristic of a potentially unhealthy population.

Intermittent

Adult returns of the target species are occasionally seen in the watershed, but there is no viable or sustained population in the basin.

Extirpated

The population has been eliminated from the watershed although the species was present in the past.

Never Present

The species has never been known to occur in the watershed.

Questionnaire

for

Information on Potential Projects to Support Spring-Run Chinook Salmon and Steelhead in the Sacramento River Basin for the Habitat Expansion Agreement

DUE: Thursday, April 30, 2009

Send completed questionnaires to hea@water.ca.gov

I. Contact Information

Name:	Gary Reedy
Organization:	South Yuba River Citizens League
Address:	217 Main Street
City, State, Zip Code:	Nevada City, Ca 95959
Phone Number:	530.265.5961 x208
Email Address:	gary@syrcl.org

II. Project Description

Project Name:	Yuba River Narrows Spawning Habitat Rehabilitation
Reference No. or New:	Basically, same as "Narrows Rehabilitation" project submitted by CDFG and FWS
Project Location:	Yuba River (0.8 miles below Englebright and immediately upstream of Deer Creek) 39deg 13' 50 N 121deg 16' 37 W

Project Description:

Compared to historic conditions, spring-run Chinook and steelhead populations of the Yuba River are severely limited by blockage from Englebright Dam. The spring-run Chinook population of the Yuba River is at high risk of extinction due to average annual abundance <500 fish, strays from the Feather River Hatchery and inadequate spawning segregation from the fall-run population. This project would restore habitat in the reach below Englebright Dam where spring-run Chinook are known to hold and attempt spawning despite a lack of suitable spawning habitat. This project may also involve a segregation weir approximately 6 miles below Englebright to provide spawning segregation from non-natal and fall-run salmon. The need and benefits for the segregation weir

II. Project Description

component of the project can be more completely evaluated following results from ongoing studies by the Yuba Accord RMT involving tagging, tracking, redd mapping and genetic analysis. Dr. Greg Pasternak of UC Davis has thoroughly described the physical situation in the Englebright Dam Reach (EDR). Although the Armcy Corps of Engineers is required to implement a gravel augmentation program, no such program will provide benefits to salmon and steelhead until the channel is rehabilitated from instream gravel mining and deposition of shot rock. With rehabilitation and the provision of 100,000 tons of gravel, the Englebright Dam Reach could support at least 2000 spawning spring-run Chinook. Gravel supply would then be maintained as per requirements of the Corps. The benefits of this project, for steelhead in particular, would be expanded with gravel augmentation in Deer Creek which enters the reach near the location of highest potential for spawning habitat enhancement.

III. Species Limiting Factors

In this section, describe the limiting factors for spring-run Chinook salmon and steelhead in your watershed. The last page of this questionnaire defines the limiting factors.

Limiting Factors	Description (from back page)	Rank
☒ **Channel Form**	Instream gravel mining and deposition of shot rock has made the channel at the project location unsuitable for spawning, even with restoration of annual gravel supply. More generally, the channel form in the lower Yuba is affected by lack of gravel supply in upper reach (i.e. downcutting) and artificial confinement from RM 7 to RM 21 (goldfields) resulting from walls of mine tailings.	High
☐ **Channel Unit Types**		Select Rank
☒ **Substrate**	Englebright Dam blocks transport of all gravels into the channel below. Spawning habitat exists beginning two miles below the dam as material becomes entrained from historic terraces and mine tailings	High
☒ **Structure**	see note below	Medium
☐ **Flow**		Select Rank
☐ **Temperature**		Select Rank
☐ **Water Quality**		Select Rank
☒ **Passage**	Englebright Dam blocks access to the majority of spawning habitat in the watershed for spring-run and steelhead; No segregation provided for spawning of spring-run.	High
☒ **Riparian/Floodplain**	see note below	Medium

Source Documents:

Pasternack Manuscript on Englebright Dam Reach, Draft Implemention Plan for Lower Yuba River Anadromous Fish Restoration, Recovery Plan for Central Valley Spring-run Chinook and Steelhead (Co-manager Draft).

Additional Notes:

For description and sources for structure and riparian/floodplain as limiting factors in the lower Yuba River, see submitted information for Yuba River Rearing Habitat Enhancement

IV. Project Objectives—Environmental

In this section, describe how your project will affect one or more of the limiting factors for spring-run Chinook salmon or steelhead described above.

Limiting Factor	Description and Objective	Focus
☒ **Channel Form**	Rehabilitation of channel form by shot rock removal and regrading as necessitated following final analysis of alternatives	Primary
☐ **Channel Unit Types**		Select Focus
☒ **Substrate**	Placement of 100,000 tons of spawning gravel to be followed by program of gravel augmentation/maintenance by the Army Corps	Primary
☒ **Structure**	Through association with Yuba River Rearing Enhancement Project	Secondary
☐ **Flow**		Select Focus
☐ **Temperature**		Select Focus
☐ **Water Quality**		Select Focus
☒ **Passage**	Through association with Deer Creek Gravel Augmentation and Passage Project submitted by Friends of Deer Creek	Secondary
☒ **Riparian/Floodplain**	Through association with Yuba River Rearing Enhancement Project	Secondary

V. Project Objectives—Biological

In this section, describe the objective(s) of your project relative to the goal of providing habitat for spring-run Chinook salmon and steelhead. Indicate the species and life stage that are targeted by the project. (It is okay to have more than one species/life stage target).

Target Species: ☒ Spring-Run Chinook Salmon **Population Status Specific to Watershed:** Decreasing

Target Life Stages:

☒ Spawning ☒ Egg Incubation ☒ Summer Rearing ☐ Winter Rearing

☐ Juvenile Emigration ☐ Adult Immigration ☐ Adult Holding

Description of Project Objectives:

Provide spawning habitat in the Englebright Dam Reach of the Yuba River to support 2000 or more spring-run Chinook salmon and enhance juvenile productivity. Also, to provide spatial segregation during spawning from summer immigrants and fall-run Chinook as needed to protect phenotypically or genetically distinct spring-run Chinook. Note: Based on results from gravel placement in Mokelumne River (Joe Merz, personal communication), 100,000 tons of gravel could be sufficient to support this spawning population and greatly enhance production of macroinvertebrates representing food sources for juvenile salmonids.

V. Project Objectives—Biological

Target Species: ☒ Steelhead

Population Status Specific to Watershed: Decreasing

Target Life Stages:

☒ Spawning ☒ Egg Incubation ☐ Summer Rearing ☐ Winter Rearing

☐ Juvenile Emigration ☐ Adult Immigration

Description of Project Objectives:

Increase the availability of suitable spawning and incubation habitat in the Narrows reach of the Yuba River, to provide for increased spawning success and juvenile productivity for steelhead. Also, this project is complimentary with gravel augmentation in Deer Creek (as proposed by Friends of Deer Creek) which could provide additional benefits in the confluence area for both species and more than 4 miles of expanded spawning and rearing for steelhead.

VI. Project Cost

Capital Cost:	$3.1M for habitat rehabilitation (based on $30/ton placed gravel plus engineering and design), plus $ 219,000 for weir
Annual Operation and Maintenance Cost:	$52,000 annually for weir operation and monitoring
Annual Operation and Maintenance Description:	The Corps is obligated to provide sufficient gravel to channel below Englebright to maintain habitat at no cost to project (estimated by Pasternak to be 10,000 tons). Segregation weir would involve full-time staff for 3.5 months/year plus assembly and disassembly.
Project Lifespan:	30 years
Project Partners (Funding):	PG&E (tbd per Narrows Mitigation Fund), FWS (AFRP)
Project Partners (Maintenance):	Army Corps (tbd for gravel augmentation/maintenance); Yuba County Water Agency (tbd for support of weir and monitoring)

VII. Schedule

Proposed Start:	2010
Expected Time to Completion:	2 months for construction period
Expected Time to Realize Environmental Benefits:	2011
Expected Time to Realize Biological Benefits:	2011

VIII. Feasibility

Technical Feasibility:	Similar spawning habitat rehabilitation has been conducted in the Central Valley, including on the Mokelumne and Tuolomne Rivers. Resistance board segregation weirs are versatile and used by fisheries managers throughout the region. Cramer Fish Sciences staff, who pioneered the use the technology in California, has provided reconnaissance and confirmed feasibility on the Yuba River. For more information, see their resistance board weir website at http://weir.fishsciences.net.
Technical Challenges:	The Yuba River has limited flood control above Englebright and constructed spawning channels will be subject to scouring forces. Additional analysis is required to determine appropriate site rehabilitation techniques before gravel placement. For example, complete shot rock removal may not be required. Also, shot rock near the dam must be stabilized to prevent future impacts.
Related Projects:	Gravel augmentation proposed by Friends of Deer Creek would add substantially to the amount of expanded steelhead habitat in this area. Restoration of off-channel rearing habitat in the Parks Bar to Hammon reach of the Yuba River (as proposed by USFWS and SYRCL) would address a limiting factor for spring-run Chinook and steelhead juveniles. The Corps of Engineers is required by a NMFS BiOp to implement a program of gravel augmentation by the fall of 2012. However, this program is not likely to start before site rehabilitation for which no entity has been made responsible. Nevertheless, the Corps program should be solidified before completion of this project.
Ownership or Permitting Challenges:	Access to rehabilitation site requires either permission from two private landowners so far offering less than consistent support, or construction of road on steep slopes of PG&E mitigation land. CDFG has expressed concerns about the new road and immediate impacts of the project on holding spring-run salmon.
Conflicts with Cultural, Zoning, or Other Issues:	None determined

IX. Project Support

Supporting Entities:	FWS, CDFG, NMFS, SYRCL; PG&E support to be determined.
Cooperating Entities:	Friends of Deer Creek, UC Field Station; Yuba County Water Agency cooperation to be determined.
Degree of Local Support:	Yuba County Resource Conservation District has proposed a pilot phase of this project for funding by the Sierra Nevada Conservancy. This project is expected to have a high degree of local support because it recovers spring-run and steelhead populations without altering water management, recreation or access. If used, a segregation weir would block only the relatively small portion of salmon attempting to migrate into the upper reach from July 1 to October 15.
Known Opposition:	The segregation weir component will have opposition without data to demonstrate lack of sufficient natural segregation. One of two immediate landowners in the rehab location may prove oppositional.

X. Supporting Documents

Please provide a full reference for each citation used to support the information presented in this questionnaire.

Pasternack and others, Manuscript 2009, Historical Analysis of the Englebright Dam Reach of the Lower Yuba River, CA to Aid Spring-run Chinook Salmon Habitat Rehabilitation.

Shira-based river analysis and field-based manipulative sediment transport experiments to balance habitat and geomorphic goals on the Lower Yuba River. http://pasternack.ucdavis.edu/LYR3_Pasternack_FINAL.pdf

NMFS, Central Valley Spring-run and steelhead recovery plan (co-manager draft)

Draft Implementation Plan for Lower Yuba River Anadromous Fish Habitat Restoration. October 2005. Lower Yuba River Fisheries Technical Working Group. CD Distribution

Merz JE, Ochikubo Chan LK. 2005. Effects of gravel augmentation on macroinvertebrate assemblages in a regulated California river. River Research and Applications 21: 61–74. DOI: 10.1002/rra.819

Merz JE, Setka JD, Pasternack GB, Wheaton JM. 2004. Predicting benefits of spawning habitat rehabilitation to salmonid fry production in a regulated California river. Canadian Journal of Fisheries and Aquatic Science 61: 1433–1446. DOI: 10.1577/M03-038.1

Definitions of Limiting Factors for Spring-Run Chinook Salmon and Steelhead

Channel Form

This attribute describes changes to the channel, including incision, aggradation, diking, armoring, and other modifications of the channel adversely affecting spring-run Chinook salmon and steelhead.

Channel Unit Types

Examples of geomorphic features of the channel that form habitat types for spring-run Chinook salmon and steelhead are pools, riffles, glides, and runs. This attribute describes changes in the frequency and size of such features. For example, removal of large wood may reduce the frequency of pools, presence of steps, or retention of gravel for riffles.

Substrate

This attribute describes changes in the composition of the substrate of the stream, including increase in fine sediment and lack of gravel recruitment.

Structure

This attribute describes the loss of structural elements in the stream such as large wood, boulders, undercut banks, and so on. Loss of structure results in a simplification of the channel and influences Channel Form and Channel Unit Types.

Flow

This attribute addresses modification of the flow regime, including decrease in summer low flow, increased "flashiness," and dewatering of the channel as a result of withdrawals.

Temperature

Change in water temperature can be attributable to human actions such as removal of riparian shading. This attribute describes the increase in summer water temperature and the loss of temperature refugia (springs or groundwater) as a result of human actions.

Water Quality

This attribute pertains to the input to the stream of toxins or pollutants that produce adverse impacts on spring-run Chinook salmon or steelhead. This can include chemical pollutants such as fertilizer and pesticides and nutrient sources such as cattle and feedlots.

Passage

This relates to the effect of impediments to adult or juvenile migration of spring-run Chinook salmon or steelhead, including dams, culverts, channel dewatering, and other structural and channel modifications. Please describe the location of the passage impediment and describe the extent of impediment (i.e., a complete or partial blockage to migration).

Riparian/Floodplain

This attribute describes the loss of functionality of the riparian forest/vegetation and the connection of the stream to the floodplain during high water and flooding.

Population Condition Definitions for Section V. Project Objectives—Biological

Increasing

Adult returns of the target species to the watershed have generally been increasing over the last several years; expectations are that the species is displaying characteristics of a rebuilding or healthy population.

Stable

Adult returns of the target species to the watershed show no clear trend over the last several years.

Decreasing

Adult returns of the target species to the watershed are declining over the last several years; the decline in abundance is a cause of concern and characteristic of a potentially unhealthy population.

Intermittent

Adult returns of the target species are occasionally seen in the watershed, but there is no viable or sustained population in the basin.

Extirpated

The population has been eliminated from the watershed although the species was present in the past.

Never Present

The species has never been known to occur in the watershed.

Questionnaire

for

Information on Potential Projects to Support Spring-Run Chinook Salmon and Steelhead in the Sacramento River Basin for the Habitat Expansion Agreement

DUE: Thursday, April 30, 2009

Send completed questionnaires to hea@water.ca.gov

I. Contact Information

Name:	Joanne Hild
Organization:	Friends of Deer Creek
Address:	132 Main Street
City, State, Zip Code:	Nevada City, CA 95959
Phone Number:	530-265-6090
Email Address:	joanne@friendsofdeercreek.org

II. Project Description

Project Name:	Deer Creek Salmon and Steelhead Spawning Habitat Expansion Project
Reference No. or New:	
Project Location:	Deer Creek between Lake Wildwood and the confluence with the Yuba River. 39.2358 deg N; 121.2190 deg W at the Lake Wildwood dam.

Project Description:

The Deer Creek Salmon and Steelhead Habitat Expansion Project is an effort to restore critical habitat for Spring-run Chinook salmon and steelhead through a combination of targeted gravel augmentation, barrier removal, invasive species removal, riparian revegetation, and collaboration with affected stakeholders, especially Lake Wildwood. In August 2008 the California Department of Fish and Game included Deer Creek on its list of 22 priority streams for future instream work. The list was compiled and ranked based on input from Regional DFG staff, staff from the State Water Board, U.S. Fish and Wildlife Service, and the National Marine Fisheries Service, using the following criteria: 1) Presence of anadromous species; 2) likelihood that DFG flow recommendations would provide a high level of improvement; 3) availability of recent flow studies or other relevant data; and 4) the possibility of

II. Project Description

partners/willing landowners. This proposal is offered in conjunction with the Yuba River Narrows Spawning Habitat Rehabilitation Project proposed by South Yuba River Citizens League.

The mouth of Deer Creek was once an exceptionally rich salmon and steelhead habitat for the Yuba River. Salmon and steelhead were present on Deer Creek and Squirrel Creek, a tributary of Deer Creek, in large numbers in the early part of the 20th century. Steelhead were observed in the 1960's in the first quarter mile of Deer Creek, until the impassible falls, and salmon were observed in large numbers in the 1920's (Yoshiyama, Gerstung, Fisher, and Moyle).

Lake Wildwood reservoir dam on Deer Creek, constructed in 1970, blocks the downstream movement of gravel that is essential for fish spawning habitat, and causes severe impacts to all elements of Deer Creek's riverine function, especially temperature, flow, and nutrient loads. Friends of Deer Creek has worked for the past several years with the Lake Wildwood Lake Committee to make changes to their recreational management of the reservoir that take into account the impacts to the creek. Much work remains if Deer Creek's salmon and steelhead spawning habitat is to be restored and expanded. This proposal is an effort to mitigate the impacts to the creek and make permanent changes in the management of the system that prevent the impacts from recurring.

Assessment, planning and design can begin immediately, with implementation beginning in September 2009. All necessary permits for the implementation of this project have been submitted.

The project elements are as follows:

1. Gravel Augmentation: Lake Wildwood dam is located four and a quarter miles above the confluence with the Yuba, where it has a detrimental impact on Deer Creek's remaining salmon and steelhead spawning habitat. The primary objective of this project is to work with Lake Wildwood to recover the gravel that is prevented by the dam from passing downstream, and to place it along with purchased gravel as needed in the gravel-starved lower reaches of Deer Creek that are critical spawning habitat. While mercury-laden fines are able to cross the dam during storm and dewatering events, larger gravel and pebbles are prevented from passing. Replacement of gravel below the dam will restore a critical ingredient of salmonid spawning habitat as well as a vital but poorly understood element in the overall function of the stream, with beneficial impacts to temperature, flow, oxygenation, and fish and other wildlife populations.

2. Revegetation: We propose a revegetation effort for the four and a quarter mile stretch of creek from the Lake Wildwood dam to the confluence. The effort will focus on the riparian zone, meadow/floodplain areas and upland zones. Like most of the watershed, this area is infested with invasive non-native species that outcompete beneficial native species and interact with the climatic conditions to create parched, tinder-dry conditions in the long hot summers. Of particular concern are Himalayan Blackberry (Rubus discolor), Black Locust trees (Robinia pseudoacacia) and non-native grasses in the riparian zone, Scotch Broom (Cytisus scoparius) and Yellow Star Thistle (Centaurea solstitialis) in the meadow areas, and Ripgut grass in the upland areas. Revegetation from the native palette would restore the capacity to uptake nutrients, thereby reducing the extent of algae blooms that have severely impacted lower Deer Creek. Algae blooms cause large diurnal swings in pH, creating conditions that are lethal to native aquatic organisms. These algae blooms and resulting pH increases have caused the State Board to include Deer Creek as an impaired watershed for pH on the 303(d) list. Revegetation will increase tree cover in the riparian zone, thereby reducing direct solar radiation available as energy for algae. Invasive Himalayan blackberry, prevalent throughout the riparian zone, provides little shade and blocks access to the creek for larger animal species. Blackberry also contributes to erosion as the stream flows around the rootball, undermining the soil. By contrast, native willows overhang the water, remain lush and green all summer long, hold the soil in their roots, and provide copious shade that keeps the water cool. Their roots provide habitat and protection from predators for a variety of animal species. Revegetation of denuded sections of the riparian zone will also help control sediment loads in the creek that result from erosion. This stretch of creek is dominated by a single highly pollution-tolerant macroinvertebrate family, indicating overall ecological degradation. Improved riparian habitat is likely to result in increased macroinvertebrate diversity in addition to providing numerous habitat and water quality benefits for the target species and other riverine and riparian dependent species.

3. Barrier Removal: The third project element is the assessment and removal of barriers to anadromous fish passage. Salmon and steelhead were once present for several miles along Deer Creek and its tributaries, but their range is now limited to the first quarter mile of stream. At this point, a large and impassible waterfall, known as Basher

II. Project Description

Falls, prevents their passage. Salmon were once able to ascend these falls because the presence of gravels in the creek maintained the height of the stream bed and prevented the creek from incising, and large woody debris acted as natural fish ladders to facilitate fish passage. Gravel loads upstream of the falls will restore stream elevation, and targeted gravel placement at the falls will focus on restoring passibility. Native trees, once established, will provide the necessary large woody debris. In addition, we will explore and implement other options for restoring passibility to the falls as indicated. We will also survey any additional barriers to fish passage that lie between the confluence and Lake Wildwood, in an effort to expand habitat range to the entire 4.25 mile stretch of creek, and up to 2.5 additional miles of Squirrel Creek, a tributary of Deer Creek below Lake Wildwood.

4. Collaborative Management of Lake Wildwood and Wastewater Treatment Plant: Lower Deer Creek's potential salmon and steelhead spawning habitat is gravely compromised by the presence of Lake Wildwood dam and wastewater treatment plant, with water temperatures in the fall that are lethal to fish, severe lack of suitable gravels, and an extreme excess of nutrients that contribute to rampant algae blooms. Restoration of viable habitat in this creek, the last tributary spawning grounds for the Yuba River before fish passage is blocked by Englebright Dam, depends on Lake Wildwood's and the Wastewater Treatment Plant's adoption of management practices that reduce impacts to the downstream ecosystem. Necessary changes include increasing the summer flow in order to reduce downstream temperature; releasing from cooler deep waters; collecting gravel during dredge operations for downstream placement; reducing the high flows during the periodic release by further lengthening the duration of the release; and reducing the input of nutrients from the Wastewater treatment plant. Central Valley Regional Water Quality Control Board is in the process of imposing stricter limits on nitrates and phosphates in effluent in order to meet their regional targets. Lake Wildwood has chosen Friends of Deer Creek to implement salmon habitat restoration improvements as a mitigation for their excessive nutrient loads, and that project will complement the current proposal. New technology exists that will result in reduced nutrient loads when implemented. Friends of Deer Creek has established a good working relationship with the Lake Wildwood Lake Committee over the course of several years, in the interest of preserving our shared environment. The fruits of this collaboration are already evident in changes that the Lake Committee has implemented in lengthening the duration of the periodic release, thereby reducing the high flows; posting signs that warn anglers of the dangers of mercury in fish; developing a joint water quality monitoring program at four sites in and below the reservoir; creating an inspection station for boats to prevent the spread of invasive non native species including quagga mussels; and collaborating in a study of mercury-laden sediment that is transported over the dam during storms. Friends of Deer Creek's board of directors includes John Norton, a Lake Wildwood resident, member of the Lake Committee, and retired program director at the California State Water Resources Control Board, who has been instrumental in establishing a partnership.

III. Species Limiting Factors

In this section, describe the limiting factors for spring-run Chinook salmon and steelhead in your watershed. The last page of this questionnaire defines the limiting factors.

Limiting Factors	Description (from back page)	Rank
☒ **Channel Form**	Lake Wildwood Dam's construction in 1970 has resulted in drastic changes to the channel form below the dam in the critical salmon spawning reach. While the presence of the dam has not essentially changed the peak flow, the dam prevents the passage of gravels that modulate flow. The fact that there is flow capable of transporting and depositing gravel without a supply of gravel has resulted in the creek incising into its bedrock and alluvium below Lake Wildwood to the confluence. The availability of flow but not of gravel and cobbles has also had the effect of incising the creek at the falls and steepening the gradient, transforming the falls into an impassible obstacle and limiting salmon and steelhead habitat range to the quarter mile stretch between the falls and the confluence. A further	Critical

III. Species Limiting Factors

	consequence of the combination of high flow and gravel starvation is bed armoring, particularly in reaches from Lake Wildwood to Squirrel Creek. Bed armoring is a particular problem in alluvial reaches, resulting in a reduction in habitat diversity. Finally, there is a large amount of angular sediment below the dam due to local erosion caused by construction at Lake Wildwood. Source data: Friends of Deer Creek Geomorphic Assessment, based on protocols developed by Montgomery and Buffington 1997.	
☒ **Channel Unit Types**	The lack of sediment has contributed to a reduction in riffle frequency caused by changes to the substrate. The stretch of creek below Lake Wildwood to the confluence with Squirrel Creek is particularly impacted by infrequency of riffles. The reduction in riffle habitat has the potential to raise temperatures, lower dissolved oxygen concentrations, and reduce habitat suitability. The lack of sediment also causes the creek to incise into alluvial step pools, reducing turbulent flows and dissolved oxygen concentrations. The reduction in gravel has also led to the deepening of pools, making them less suitable for spawning because of the loss of oxygenated flow. Deep pools can reduce the hyporheic flows needed to buffer daily temperature swings. Deep pools also reduce dissolved oxygen concentrations and contribute to algae blooms. Finally, the dam blocks large woody debris which can provide side channel pool habitat and help with gravel retention, thereby creating riffles and increasing the suitability of pools for spawning. The lack of woody debris decreases the diversity of channel units. Source data: Friends of Deer Creek Geomorphic Assessment, based on protocols developed by Montgomery and Buffington 1997.	High
☒ **Substrate**	Lake Wildwood dam blocks gravel and cobbles which would provide habitat to lower Deer Creek. The reach between Lake Wildwood and Squirrel Creek is particularly impacted, with only localized sediment inputs. The composition of the streambed below Lake Wildwood has been fundamentally altered since the construction of the dam because the reduction of the sediment supply has led to bed armoring, and a large median substrate diameter unsuitable for spawning salmonids. Fine sediment however is able to pass downstream, leading to a disproportionate amount of fine substrate too small for spawning habitat. Localized gravel recruitment leads to uneroded, angular gravels. The entire system is starved of suitable gravel supply because of the presence of the dam. Source data: Wolman Pebble Counts done in conjunction with Geomorphic Assessment.	Critical
☒ **Structure**	The presence of two dams (Lake Wildwood and Scotts Flat) has interrupted the continuous system that would bring large woody debris from upland forests. The lack of woody debris affects the distribution and spacing of riffles, runs, and pools. Debris creates unique and diverse habitat types including side channel pools, lateral pools, mid channel pools, and riffles.Source data: Friends of Deer Creek Geomorphic Assessment, based on protocols developed by Montgomery and Buffington 1997; Physical Habitat Assessments conducted in 2007 and 2008 in accordance with SWAMP Stream Habitat Characterization Form; Desktop analysis	High

III. Species Limiting Factors

	using Google Earth to assess canopy cover.	
☒ **Flow**	Lake Wildwood has a severe impact on flow, with inadequate flow in the summer months and unseasonal high flows during the annual dewatering. The dewatering event mimics a storm event, triggering salmon and steelhead to begin their upstream journey to spawn, where the eggs then dry up when the waters recede. The high flows also scour the vegetation and macroinvertbrates from the downstream section of the creek, causing severe impacts to riparian vegetation and habitat. The area is dominated by a single macroinvertebrate family, blackflies (Simulidae), and suffers from a critical lack of the macroinvertebrate diversity needed by salmonids. The entire Deer Creek watershed functions as a water management system. The natural flow regime would allow snowmelt to pass all the way into lower Deer Creek. Snow melt is now blocked and diverted at numerous places. Winter high flows are similar to historic highs, but data collected since 1934 reveals a significant reduction in summer flows resulting from Lake Wildwood's flow management (USGS). Below Lake Wildwood, less flow results in more pronounced diurnal temperature swing, and more severe environmental stresses on organisms. Source data: Flow regime analysis using USGS gauge data and Army Corps of Engineers Hydrologic Engineering Center Statistical Software Package.	Critical
☒ **Temperature**	Temperature is an urgent limiting factor in Lower Deer Creek. Temperature increases caused by human actions are a severe problem in lower Deer Creek. Temperatures of 24 degs C are lethal to salmonids, with 23 degs C being the LT50 (Baker). Ten years of temperature data on Deer Creek in the salmonid spawning reach reveal lethally high temperatures in the summer and fall spawning season, with peaks of 30 degs C (Friends of Deer Creek). Management activities on private land such as grazing, logging, gravel mining, and agriculture have led to degradation of the riparian corridor, reduction in riparian habitat and invasion by non-native plant species that bring reduced shade and habitat benefits. The lack of gravel and cobble in the streambed has led to a deepening of pools and a reduction in turbulent riffle flow and riffle spacing, all of which factors can lead to temperature increases (Grant et al, 2006). Managed flow from Lake Wildwood has significant impacts on downstream temperature caused by several factors: summer release of warm water from surface waters of the reservoir; extremely low outflows in summer in order to conserve reservoir depth; and a lack of natural variation in both flow and temperature, reducing the potential for hyporheic exchange to act as a temperature buffer (Poole & Berman). Source data: Friends of Deer Creek monthly water quality data; Onset HOBO data logger data during Lake Wildwood dewatering.	Critical
☒ **Water Quality**	The primary impacts to the water quality are nutrient loads, algae, and large diurnal swings in pH and temperatures.The wastewater treatment plant at Lake Wildwood releases significant quantities of nutrients into lower Deer Creek, which have contributed to excessive algae blooms. Algae take in oxygen and release carbon	Critical

III. Species Limiting Factors

	dioxide, leading to large diurnal swings in pH and dissolved oxygen, with severe impacts on stream organisms. Deer Creek below Lake Wildwood is 303(d) listed for pH as a result of excessive nutrient loads (http://www.waterboards.ca.gov). The impact of nutrient-laden effluent from the wastewater treatment plant is especially pronounced in summer when the low flows prevent effluent dilution. The lack of riparian canopy also increases the availability of solar radiation to the streambed, contributing to algae blooms. Denuded riparian areas do not uptake nutrients, leaving the nutrients available for algae growth. Source data: Friends of Deer Creek monthly monitoring data.	
☒ **Passage**	Fish passage is completely blocked by a waterfall located a quarter mile above the confluence with the Yuba River. Salmon and steelhead were historically able to scale these falls, but the lack of gravel, cobbles and large woody debris to act as natural fish ladders, has caused the creek to become deeply incised and the falls to become too steep to pass. Source data: Visual and Geomorphic Assessment based on protocols developed by Montgomery and Buffington 1997.	Critical
☒ **Riparian/Floodplain**	The riparian vegetation is significantly compromised both by the spread of invasive non-natives, and by private land management including grazing, logging, mining, and residential development, that has caused the banks to become denuded in places. Aerial photography reveals severely degraded vegetation in more than half of Deer Creek's riparian zone between Lake Wildwood and the Yuba confluence, and even more of Squirrel Creek's riparian zone in 3.2 miles above the confluence with Deer Creek.These impacts result in temperature increases, a reduction in nutrient uptake capacity, and the loss of fish and macroinvertebrate habitat. Riparian vegetation has been found by many studies to be critical in regulating stream temperature (Johnson & Jones, 2000). Riparian areas with higher plant density and basal area have temperatures up to 11% lower than areas with significantly lower plant density and basal area (Opperman & Merenlender, 2004). Non natives such as blackberry outcompete native species such as willow, alder, and cottonwood that provide suitable habitat including canopy, shading, root mats and root wads. The composition of the riparian vegetation zone is crucial to stream temperature regulation, and must include tree species that provide canopy (Broadmeadow & Nisbet, 2004). The riparian zone at the site is currently dominated primarily by shrub-like Himalayan blackberry and Scotch broom, which do not provide the necessary canopy cover to effectively regulate the stream temperature. Non natives such as scotch broom are more susceptible to wildfire, which in turn increases fine sediment load to the creek. Grazing animals cause further impact to native vegetation by spreading non-native seeds and by trampling and compacting soil, making it less hospitable to native species that require specific soil characteristics in order to be successful. The lack of large native riparian trees reduces the availability of large woody debris in the creek necessary for habitat and for fish passage. The lack of gravel has caused the creek to become incised, particularly in the alluvial reaches, and unable to access its	Critical

III. Species Limiting Factors

floodplain. Source data:Physical Habitat Assessments conducted in 2007 and 2008 per SWAMP Stream Habitat Characterization Form; Habitat Assessment conducted in conjunction with Friends of Deer Creek twice yearly Macroinvertebrate Bioassessment since 2000; streamwalk visual assessment, May 2008.

Source Documents:

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Additional Notes:

IV. Project Objectives—Environmental

In this section, describe how your project will affect <u>one or more</u> of the limiting factors for spring-run Chinook salmon or steelhead described above.

Limiting Factor	Description and Objective	Focus
☒ **Channel Form**	The gravel augmentation effort will affect the channel form by reducing the rate of channel incision into the streambed and bedrock. The armoring of the streambed that prevails in the reach between Lake Wildwood and Squirrel Creek will be mitigated by providing a	Primary

	more natural and diverse substrate regime, balancing out the large boulders and bedrock with smaller gravel, and reducing the incision rate. The project objective is to reduce the median substrate diameter by 25%.	
☒ **Channel Unit Types**	The project will place gravel in the sediment-starved reach of Deer Creek below Lake Wildwood, creating riffles and side pools that are necessary to decrease temperature and increase dissolved oxygen. Replacement of gravel will also prevent the creek from incising and developing deep stagnant pools. The revegetation project will provide sources of large woody debris that help to create diverse channel unit types. The project objective is to increase riffle habitat by 30%.	Primary
☒ **Substrate**	The addition of gravel recovered from Lake Wildwood and from Yuba River sources will reduce the median substrate diameter to a diameter more suitable for salmon spawning. Diverse substrate will reduce incision and create more spawning bed habitat. The presence of large quantities of angular sediment from local sources will be mitigated by a combination of removal of angular gravel where practical and increased abundance of rounded pebbles more suitable for spawning habitat. Finally, the addition of diverse substrate will create more hyporheic flow by creating riffles and raising the bed elevation, resulting in reduced temperature and increased dissolved oxygen levels. The project objective is to reduce median substrate diameter by 25%.	Primary
☒ **Structure**	The proposed revegetation effort in the riparian zone below Lake Wildwood and along Squirrel Creek will replace low-lying invasive shrubs with native trees, resulting in local sources of large woody debris. Woody debris facilitates the creation of riffles and pools, and acts as a natural fish ladder. The project objective is to increase woody debris biomass by 100%.	Primary
☒ **Flow**	The gravel augmentation will affect the flow regime by raising the bed elevation, decreasing surface flow and increasing subsurface hyporheic flow. The revegetation will affect flow by providing a source of large woody debris which will create diverse channel unit types and an increase in riffles and sidepools. We will negotiate with Lake Wildwood and Nevada Irrigation District (NID) to make changes to their future management strategies that may include releasing colder water, reducing flow during the periodic dewatering by lengthening the timeframe, and ensuring that the summer release meets the minimum flow levels required under the terms of their permit. The project objective is to ensure that Lake Wildwood's spring, summer and fall flows meet their permitted requirements 100% of the time.	Primary
☒ **Temperature**	The project will realize significant improvements to temperature. We plan to import gravel recovered from Lake Wildwood and from the Yuba River, to create riffles that have the capacity to reduce temperature and increase dissolved oxygen. We will work with Lake Wildwood to manage the summer release of water from a lower depth, so that colder water is entering the stream. We will work with landowners to fence grazing animals out of the riparian zone so that	Primary

IV. Project Objectives—Environmental

	native vegetation can become established, and will focus revegetation efforts on increasing the supply of native shade trees. The project objective is to reduce instances of lethal temperature peaks to zero.	
☒ **Water Quality**	Water quality impacts are interconnected, with the lack of riparian vegetation and canopy contributing to high temperatures and the growth of excessive algae blooms, which in turn leads to large diurnal swings in pH and temperature. The proposed revegetation will increase canopy and overall biomass, thereby increasing the capacity to uptake the nutrients that feed algae blooms and reducing temperature and solar radiation, further reducing algae blooms. The reduction of algae blooms in turn will reduce pH and dissolved oxygen concentration swings. The gravel augmentation will raise bed elevation and create riffle habitat, with increased turbulence that increases dissolved oxygen concentrations. The gravel will also increase subsurface flow to provide a buffer against temperature spikes. We will reduce algal biomass by 25%, and nutrients by 25%.	Primary
☒ **Passage**	The project will include an effort to restore passibility to the falls a quarter mile from the Yuba confluence in order to regain four miles of salmon habitat on Deer Creek and up to 2.5 miles on Squirrel Creek. It is hypothesized that the falls have become excessively steep for a combination of human-caused reasons, including the lack of gravel that causes the creek to incise, and the geomorphological changes to the creek that were caused by intensive gold mining in the creek beginning in the Gold Rush. We plan to restore passibility by a combination of gravel augmentation to raise the streambed height and fall height reduction, by removing accumulated debris at the top of the falls. The project objective is to increase habitat range by 4 miles on Deer Creek and 2.5 miles on Squirrel Creek.	Primary
☒ **Riparian/Floodplain**	The project includes an extensive revegetation effort along 4.25 miles of Deer Creek and an additional 3.2 miles of Squirrel Creek. The denuded areas will be replanted with native trees; invasive non-natives will be removed and replaced with native vegetation; and grazing animals that compact the soil and eat the seedlings will be fenced away from the riparian zone. The gravel augmentation effort will prevent the creek from incising and will allow it to access its floodplain. Friends of Deer Creek's wide volunteer network and relationships with private landowners make us uniquely positioned to implement revegetation efforts on private land and to work with landowners to make beneficial changes to private land management practices. We will reduce the total denuded area of the riparian zone from 33% to 15%.	Primary

V. Project Objectives—Biological

In this section, describe the objective(s) of your project relative to the goal of providing habitat for spring-run Chinook salmon and steelhead. Indicate the species and life stage that are targeted by the project. (It is okay to have more than one species/life stage target).

Target Species: ☒ Spring-Run Chinook Salmon **Population Status Specific to Watershed:** Intermittent

Target Life Stages:

☒ Spawning ☒ Egg Incubation ☒ Summer Rearing ☒ Winter Rearing

☐ Juvenile Emigration ☒ Adult Immigration ☐ Adult Holding

Description of Project Objectives:

The objective of the project is to increase the proportion of Yuba River salmon found on Deer Creek by 5-10%. The habitat requirements for spring-run Chinook salmon will be addressed in the following manner by the proposed project:

Adult Immigration: High temperatures deter adult salmon from entering their natal streams, and are a problem in Deer Creek for the reasons stated in III above. Our monthly monitoring data, available on our website, indicates that the temperature range in the creek is just above the upper limit of tolerable temperature range. High temperature peaks and extreme temperature swings will be addressed by revegetating to increase shade; by adding gravel to increase riffle habitat and hyporheic flows; and by working with Lake Wildwood management to release water in summer from lower and colder depths of the reservoir. Migrating salmon avoid streams with excessive turbidity. Deer Creek's turbidity is not excessive, but the revegetation project will address sediment loads by vegetating denuded banks to reduce erosion. We will also work with landowners to fence grazing animals away from the riparian zone, where they contribute to erosion by compacting the soil and eating seedlings. In order to expand the available habitat on Deer Creek beyond the current 1/4 mile, it is necessary to address the impassibility of Basher Falls and determine whether it can be made passible. A survey of the falls will examine pool depth to falls height ratio, vertical and horizontal distance, and whether an alternate route under the falls can be developed to facilitate fish passage.

Spawning: The most significant variables affecting spawning habitat are substrate composition, cover, water quality and water quantity. In terms of water quantity, flow is impacted in Deer Creek by Lake Wildwood dam, with low summer flows and unnaturally high flows during the periodic dewatering. Suitable salmon spawning habitat requires sufficient but not excessive flow, and our work with Lake Wildwood will focus on ensuring that minimum summer flows are observed and that the duration of the dewatering is extended to allow a lower flow rate. Temperature provides an important cue for spawning salmon, with the ideal temperature range being 5.6-13.9 deg C. Timing of spawning must take into account the seasonal temperatures that affect subsequent incubation success rates - successful spawning requires suitable temperatures at just the right time. As outlined above in Adult Immigration, temperature impacts will be addressed by a combination of revegetation efforts, reservoir management strategies, and gravel augmentation. Of critical importance to spawning habitat is suitably-sized substrate, with salmon requiring gravel in the range of 1.3 to 10.2 cm. Up to 80% of the gravel should be in the range of 1.3 to 3.8 cm, with the remainder up to 10.2cm. As outlined above, the targeted stretch of creek is gravel-starved as a result of the dam at Lake Wildwood that prevents the passage of gravel downstream. The gravel augmentation effort in this project will recover gravel from the reservoir and augment with purchased gravel from a Yuba River source in order to increase the ratio of suitable substrate. Finally, spawning salmon require adequate cover for shade and for protection from predators. Cover may be provided by overhanging vegetation, undercut banks, submerged vegetation, submerged objects such as logs and rocks, floating debris, deep water, turbulence, and turbidity. The project will include an extensive revegetation of the riparian zone focused on increasing native shade cover and providing a supply of large woody debris.

Incubation: While spawning habitat is also incubation habitat, the needs of embryos during incubation differ from those of adults. Of particular importance is the quantity of fine sediment that can block oxygenated flow in the redds and restrict alevin movement. The revegetation will reduce fine sediment loads by restoring erosion-prone denuded

V. Project Objectives—Biological

areas. Dissolved oxygen concentrations also have an impact on incubating salmon, with low and medium DO levels corresponding to smaller, weaker and fewer alevins. DO concentrations are impacted by temperature, surface and intragravel water interchange, substrate permeability, and oxygen demand of organic material in the redd. The project will result in increases in dissolved oxygen levels by reducing water temperature through a combination of revegetation, gravel augmentation, and changes to reservoir management; reducing algae blooms by increasing riparian vegetation that will uptake nutrients and provide shade; increasing the proportion of gravels to fine sediment; and increasing riffle habitat and thereby increasing hyporheic flow. Incubation success is influenced strongly by temperature, with temperatures in the higher end of the ideal range greatly reducing the number of days until embryos hatch. Proposed temperature mitigations are as described under "Adult Immigration", above.

Rearing: Abundance of juvenile salmon is impacted by a range of variables including vegetative cover, protection from predators, abundance of food sources, flow, water quality including DO concentrations and pH, temperature, competition, depth, velocity, and substrate. Project impacts to temperature, water quality, flow, substrate, and vegetative cover/protection from predators have been discussed in the above sections. The project will have a significant impact on macroinvertebrate habitat, with habitat improvements resulting from the revegetation and substrate improvements. Macroinvertebrates constitute the major food source for salmonids. Both suitably-sized substrate and large native trees and their woody debris are crucial in increasing macrinvertebrate populations and in providing protective cover to juvenile salmon.

Target Species: ☒ Steelhead

Population Status Specific to Watershed: Extirpated

Target Life Stages:

☒ Spawning ☒ Egg Incubation ☒ Summer Rearing ☒ Winter Rearing

☐ Juvenile Emigration ☒ Adult Immigration

Description of Project Objectives:

The project objective is to return steelhead to Deer Creek. While steelhead were historically present in the watershed, it is thought they are no longer found here. The project impacts for spring-run chinook habitat will yield comparable benefits for steelhead. The temperature range for spawning steelhead is 3.9-9.4 deg C. There is considerable overlap in the ideal range for all habitat variables for salmon and steelhead, and the project will yield benefits that will accrue to both species. While steelhead are not currently present in Deer Creek because of habitat degradation, they are still present in the Yuba River in the vicinity of Deer Creek, and it is hoped that the project will restore Deer Creek's habitat to viability.

VI. Project Cost

Capital Cost: $75,000 for equipment

Annual Operation and Maintenance Cost: $174,000 annual operation costs for the project term of 3.25 years

$275,000 annual maintenance costs

Annual Operation and Maintenance Description: For the 3.25 year term of the project, the project will salvage gravel from Lake Wildwood and purchase additional Yuba River gravel as needed; deposit the gravel below Lake Wildwood dam and at the falls annually; remove non-native riparian vegetation; revegetate with native vegetation; irrigate as needed; monitor and remove non-native vegetation; conduct meetings with Lake Wildwood Lake Committee to implement management changes; survey barriers to fish passage and remediate; implement monitoring program.

VI. Project Cost

Project Lifespan:	Funding is requested for the 3.25 year project term. Operating and maintenance activities are expected to be required indefinitely, as long as the dam at Lake Wildwood is present. Immediate benefits are expected in macroinvertebrate populations, as soon as suitable gravel is restored, with salmon and steelhead numbers showing an improvement within three years. Long term benefits in riparian vegetation will continue to accrue for the next ten years.
Project Partners (Funding):	Nevada County Sanitation District #1, a compensatory mitigation imposed by California Department of Fish and Game.
Project Partners (Maintenance):	Lake Wildwood Association will be maintenance project partners, providing salvaged gravel and other remedial actions in their management plan as developed in the scope of the project.

VII. Schedule

Proposed Start:	September 2009
Expected Time to Completion:	December 2012
Expected Time to Realize Environmental Benefits:	2019
Expected Time to Realize Biological Benefits:	December 2012

VIII. Feasibility

Technical Feasibility:

The technical elements of the project include gravel augmentation, riparian revegetation, and barrier removal.

The gravel augmentation element is feasible because we have convenient access for depositing gravel loads at Lake Wildwood dam, as well as a cooperative relationship with Lake Wildwood Lake Association who have granted us permission to access their land for this purpose. Lake Wildwood Association has been seeking solutions to the issue of gravel starvation in the lower reach, and is strongly supportive of efforts to recover gravel from the lake and place it below the dam. If the recovered gravel proves to be unsuitable or insufficient, we have identified an alternative source of gravel from the Yuba River, which can be trucked in to the site.

The riparian revegetation effort is feasible because of our strong relationships developed over many years with landowners along the creek, some of whom are volunteers and monitors for our organization. We have secured formal consent to implement revegetation efforts from landowners of approximately one third of the land area along Deer Creek between Lake Wildwood and the Yuba confluence, and will continue working to secure additional permissions. Friends of Deer Creek has already completed a similar revegetation effort that involves the removal of non-natives and replacement with native trees and plants in an upstream reach, and has developed a method of incremental removal of

VIII. Feasibility

invasives to avoid exacerbating the erosion problem; revegetation in targeted sections that can outcompete the invasive vegetation; and gathering of native seedlings and cuttings from a variety of specimens in the project area in order to ensure genetic diversity and suitability.

Barrier removal will consist primarily of a feasibility study to determine the best method of bypassing Basher Falls and implementation as appropriate. The effort to restore passibility by targeting gravel placement to elevate streambed height is made possible by good access at the falls, that will allow us to focus a specific "gardening"-style gravel placement at the site. The introduction of large numbers of native trees will restore the supply of large woody debris that in the past acted as a natural fishladder to facilitate fish passage.

Technical Challenges:

Technical challenges remain in the restoration of passibility to the falls. Anecdotal evidence suggests that historically, salmon and steelhead were able to scale these falls and were found in the upper reaches of Deer Creek, but the falls are known to have been impassible since at least the 1920's, before the construction of Lake Wildwood dam. An initial study of the falls has shown that there is an access point at the bottom of the falls approximately 10" in diameter, and that it is possible that fish passage could be occur via this route instead of up the face of the falls. If fish passage cannot be restored, the habitat range will be limited to the first quarter mile of stream above the Yuba confluence, but riparian revegetation and gravel augmentation efforts would be implemented in the entire 4.25 mile stretch of the creek between Lake Wildwood and the confluence in order to realize greater temperature and pH improvements.

The temperature peaks in the creek currently are lethal to spawning fish, and a primary goal of all elements of the project is to reduce temperature peaks and swings. The related projects below reveal that improvements in temperature suitability result from each planned remediation strategy, and taken together we believe that the project in its entirety will restore habitability.

Related Projects:

All elements of the project have been successfully implemented in other waterways:

Barrier Removal: In Puget Sound, when access to 145 rkm in the upper Skykomish River above Sunset Falls (a natural barrier) was provided, chinook and pink salmon penetrated the upper reaches of the basin, and their populations peaked in 15 and 25 years, respectively (Seiler 1991).

Nutrient Uptake: The plan to plant native plants in denuded areas and as a replacement for non-native shrubs has been shown to result in a significant reduction in nutrient loads in the creek, with willows being extremely efficient at nutrient uptake (Byrd & Kelly 2006).

Native Revegetion Benefits: A revegetation project in Mendocino County targeted at steelhead habitat restoration yielded significant temperature benefits, beneficial changes in channel morphology, and a supply of large woody debris within 10-20 years that was equal to that found on similar streams in mature forest (Opperman & Merenlender 2004).

Gravel Augmentation: East Bay Municipal Utility District has implemented a series of gravel augmentation activities over several years in the Mokelumne River just below Comanche Dam. The augmentation has yielded multiple

VIII. Feasibility

benefits, including the immediate return of spawning Chinook salmon to two sites; a 12% increase in the quantity of suitably-sized gravels; increased dissolved oxygen and decreased temperatures; and macroinvertebrate populations in the new gravel that are equal to those found in established gravel (Bjornn & Reiser, Mokelumne).

Ownership or Permitting Challenges:

We are fortunate to have developed harmonious relationships with several landowners along the creek and with Lake Wildwood. Therefore, it is not anticipated that land ownership issues will be a significant obstacle.

We have applied for the following permits for this project:

Army Corps of Engineers, Section 404 Permit

Department of Fish and Game, Lake and Streambed Alteration Permit

Central Valley Regional Water Quality Control Board, Water Quality Certification Section 401 Permit

Conflicts with Cultural, Zoning, or Other Issues:

There are no known conflicts with cultural, zoning, or other issues. On the contrary, our close collaboration with the Tsi-Akim Maidu has revealed to us that the return of the salmon people to their ancestral lands is their highest priority, as indicated by their revival of the "Calling Back the Salmon" ceremony for the past few years in the fall. Efforts to restore salmon habitat are of paramount cultural importance.

IX. Project Support

Supporting Entities:

The Tsi-Akim Maidu Tribe is supportive of the goals of this project.

Support for elements of this project is implicit in the fact that in August 2008 the California Department of Fish and Game included Deer Creek on its list of 22 priority streams for future instream work. The list was compiled and ranked based on input from Regional DFG staff, staff from the State Water Board, U.S. Fish and Wildlife Service, and the National Marine Fisheries Service, using the following criteria: 1) Presence of anadromous species; 2) likelihood that DFG flow recommendations would provide a high level of improvement; 3) availability of recent flow studies or other relevant data; and 4) the possibility of partners/willing landowners. T

Cooperating Entities:

Lake Wildwood, Nevada County Sanitation District #1, and private property owners along the affected stretch of creek have all offered their formal cooperation, and support letters are available.

Degree of Local Support:

Friends of Deer Creek enjoys a high degree of local support and places a priority on building cooperative relationships with all affected parties, private and public. Several homeowners along the creek have become volunteers and monitors; the city of Nevada City is currently partnering with us on an EPA-funded Brownfield Assessment of abandoned mines on city-owned land, and has provided us with low-rent office and lab space for the past decade; Lake Wildwood has collaborated with us on mulitple projects and, as a result of our collaboration, has modifed its management practices of the reservoir to take into account impacts to the creek; and we are developing an eight mile community trail along the creek, in partnership with several local groups, which promises to

IX. Project Support

	be a highly valued local resource and which has engendered much support and volunteer hours from a broad spectrum of the community. These relationships make it possible for us to accomplish many things that would be hard for a state agency to do, especially when access to private property is required as it is in this project.
Known Opposition:	There is no known opposition to this project.

X. Supporting Documents

Please provide a full reference for each citation used to support the information presented in this questionnaire.

Baker, P.F., Speed, T.P., and F.K. Ligon. 1995. Estimating the influence of temperature on the survival of chinook salmon smolts (Oncorhynchus tshawytscha) migrating through the Sacramento - San Joaquin River Delta of California. Can. J. Fish. Aquatic. Sci 52:855-863.

Bjornn, T.C. and D.W. Reiser. "Mokelumne River Spawning Habitat Improvement Project Monitoring". American Fisheries Society Special Publication, 1991. http://www.delta.dfg.ca.gov/AFRP/

Bjornn, T.C and D.W. Reiser. "Habitat Requirements of Salmonids in Streams." Influences of forest and rangeland management on salmonid fisheries and their habitats. W. Meehan (ed). American Fisheries Society Special Publication 19, 1991. 83-138.

Broadmeadow, S. & Nisbet, T.R. 2004. The effects of riparian forest management on the freshwater environment: a literature review of best management practice. Hydrology and Earth System Sciences 8(3), 286–305.

Byrd, Kristin B. and Maggi Kelly. Salt Marsh Vegetation Response To Edaphic And Topographic Changes From Upland Sedimentation In A Pacific Estuary. Department of Environmental Science Policy, and Management, University of California, Berkeley. Wetlands, Vol. 26, No. 3, September 2006, pp. 813–829.

California Water Resources Control Board
http://www.waterboards.ca.gov/tmdl/docs/303dlists2006/approved/BAK_Aug13thruOct30/state_06_303dlist.pdf

Friends of Deer Creek. www.friendsofdeercreek.org/data.html

Grant, Gordon et al. Potential effects of gravel augmentation on temperature in the Clackamas River, Oregon. A report prepared for Portland General Electric. 1 June, 2006

Johnson, S.L. & Jones, J.A. 2000. Stream temperature responses to forest harvest and debris flows in western Cascades, Oregon. Canadian Journal of Fisheries and Aquatic Sciences 57, 30–39.

Opperman, J.J. & Merenlender, A.M. 2004. The effectiveness of riparian restoration for improving instream fish habitat in four hardwood-dominated California streams. North American Journal of Fisheries Management 24, 822–834.

Poole, Geoffrey C. and Cara H. Berman. An Ecological Perspective on In-Stream Temperature: Natural Heat Dynamics and Mechanisms of Human-Caused Thermal Degradation. http://waterdata.usgs.gov/nwis/uv?11418500

Seiler, D. 1991. Coho production potential above Snoqualmie Falls. Open File Report, 15 January 1991. Planning, Research, and Harvest Management Division. Washington Department of Fisheries, Olympia,WA.

Yoshiyama, R. M., E. R. Gerstung, F. W. Fisher, and P. B. Moyle. 2001. Historical and present distribution of chinook salmon in the Central Valley. Pages 71-176 in R. Brown, ed. Contributions to the biology of Central Valley salmonids. Fish Bulletin 179.
http://wfcb.ucdavis.edu/www/Faculty/Peter/petermoyle/publications/CentralValleyChinook.pdf

X. Supporting Documents

Definitions of Limiting Factors for Spring-Run Chinook Salmon and Steelhead

Channel Form

This attribute describes changes to the channel, including incision, aggradation, diking, armoring, and other modifications of the channel adversely affecting spring-run Chinook salmon and steelhead.

Channel Unit Types

Examples of geomorphic features of the channel that form habitat types for spring-run Chinook salmon and steelhead are pools, riffles, glides, and runs. This attribute describes changes in the frequency and size of such features. For example, removal of large wood may reduce the frequency of pools, presence of steps, or retention of gravel for riffles.

Substrate

This attribute describes changes in the composition of the substrate of the stream, including increase in fine sediment and lack of gravel recruitment.

Structure

This attribute describes the loss of structural elements in the stream such as large wood, boulders, undercut banks, and so on. Loss of structure results in a simplification of the channel and influences Channel Form and Channel Unit Types.

Flow

This attribute addresses modification of the flow regime, including decrease in summer low flow, increased "flashiness," and dewatering of the channel as a result of withdrawals.

Temperature

Change in water temperature can be attributable to human actions such as removal of riparian shading. This attribute describes the increase in summer water temperature and the loss of temperature refugia (springs or groundwater) as a result of human actions.

Water Quality

This attribute pertains to the input to the stream of toxins or pollutants that produce adverse impacts on spring-run Chinook salmon or steelhead. This can include chemical pollutants such as fertilizer and pesticides and nutrient sources such as cattle and feedlots.

Passage

This relates to the effect of impediments to adult or juvenile migration of spring-run Chinook salmon or steelhead, including dams, culverts, channel dewatering, and other structural and channel modifications. Please describe the location of the passage impediment and describe the extent of impediment (i.e., a complete or partial blockage to migration).

Riparian/Floodplain

This attribute describes the loss of functionality of the riparian forest/vegetation and the connection of the stream to the floodplain during high water and flooding.

Population Condition Definitions for Section V. Project Objectives—Biological

Increasing

Adult returns of the target species to the watershed have generally been increasing over the last several years; expectations are that the species is displaying characteristics of a rebuilding or healthy population.

Stable

Adult returns of the target species to the watershed show no clear trend over the last several years.

Decreasing

Adult returns of the target species to the watershed are declining over the last several years; the decline in abundance is a cause of concern and characteristic of a potentially unhealthy population.

Intermittent

Adult returns of the target species are occasionally seen in the watershed, but there is no viable or sustained population in the basin.

Extirpated

The population has been eliminated from the watershed although the species was present in the past.

Never Present

The species has never been known to occur in the watershed.

Appendix D2

Questionnaire Received on the Antelope Creek Action

Questionnaire

for

Information on Potential Projects to Support Spring-Run Chinook Salmon and Steelhead in the Sacramento River Basin for the Habitat Expansion Agreement

DUE: Friday, February 27, 2009

Send completed questionnaires to hea@water.ca.gov

I. Contact Information

Name:	Brenda Olson
Organization:	U.S. Fish and Wildlife Service
Address:	Red Bluff Fish & Wildlife Office, 10950 Tyler Road
City, State, Zip Code:	Red Bluff, CA 96080
Phone Number:	530-527-3043 x227
Email Address:	Brenda_Olson@fws.gov

II. Project Description

Project Name:	Antelope Creek Tehama Wildlife Area Paynes Crossing (fish passage)
Reference No. or New:	NS-5
Project Location:	CDFG Tehama Wildlife Area, Paynes (or Middle Slab) crossing, Ishi Road. lat 40.231639, long -121.885691. Approximate elevation, 1290 ft.

Project Description:

The current road crossing is made of grate metal. The stream bed on the downstream side of the structure has downcut. Large boulders have been placed in the past to break up the velocity but that also filled in pools that spring Chinook may have used to get up and over the structure during low water years. In addition, the substrate that once filled in the grate is being washed out so juveniles moving out of the system get strained through the structure. This structure is a partial barrier, in that adults can navigate above it during high flows.

This project will build a bridge to replace the current structure. This will allow natural stream function in passage of fish, bedload, and localized narrowing of the channel where it has been impacted from the crossing impounding

II. Project Description

water/flow.

The AFRP funded environmental compliance, permitting, and engineered design in 2008. This project will be complete in 2009. Construction could begin as early as 2010. As part of the analysis, several different alternatives were looked at, however a bridge was the best option for fish, stream function, and human safety.

III. Species Limiting Factors

In this section, describe the limiting factors for spring-run Chinook salmon and steelhead in your watershed. The last page of this questionnaire defines the limiting factors.

Limiting Factors	Description (from back page)	Rank
☒ **Channel Form**	Below Edwards dam, Antelope Creek divides into many different channels. The water is divided into these channels, thereby stranding juvenile salmonids, and possibly delaying migration of adults, in low water years. When Antelope Creek overflows into New Creek at the Edwards diversion dam, the water drains into another stream, Salt Creek. This multi-channel issue is identified in the 2001 Final AFRP Restoration Plan as an Evaluation needing to be completed.	Critical
☐ **Channel Unit Types**		Select Rank
☐ **Substrate**		Select Rank
☐ **Structure**		Select Rank
☒ **Flow**	Flow is an issue downstream of the Edwards dam. In low water years the stream can be dry spring through fall. What additional water rights occur downstream of the Edwards dam is unknown.	Critical
☒ **Temperature**	The temperature limiting factor is related to flow. Temperatures become lethal in the valley floor once the air temperature rises and flow is diverted.	High
☐ **Water Quality**		Select Rank
☒ **Passage**	Adult passage is affected by the multiple channels in the lower section, the amount of flow diverted at Edwards dam, and the partial barrier in the CDFG Tehama Wildlife Area. In addition, juvenile passage is affected by the current crossing structure in the Tehama Wildlife Area, the lack of a bypass from the two diversion canals at Edwards dam, and the multiple channels below Edwards dam.	Critical
☐ **Riparian/Floodplain**		Select Rank

Source Documents:

Additional Notes:

IV. Project Objectives—Environmental

In this section, describe how your project will affect one or more of the limiting factors for spring-run Chinook salmon or steelhead described above.

Limiting Factor	Description and Objective	Focus
☒ **Channel Form**	By removing the current structure, and allowing natural bedload movement and the thalweg to establish, the channel will become narrower through the section just upstream of the structure. Currently the channel is relatively wide and slow moving during low flow.	Secondary
☐ **Channel Unit Types**		Select Focus
☐ **Substrate**		Select Focus
☐ **Structure**		Select Focus
☐ **Flow**		Select Focus
☐ **Temperature**		Select Focus
☐ **Water Quality**		Select Focus
☒ **Passage**	Removing the current structure and replacing the crossing with a bridge will allow passage at all flows and natural stream function. Adults will be able to access suitable holding and spawning habitat, increasing their survival. Depending on water year, the crossing delays or prevents upstream passage of adult spring chinook, and also entrains juvenile outmigrants. The past two spring Chinook salmon surveys (2007 & 2008) have found most, if not all, below this crossing.	Primary
☐ **Riparian/Floodplain**		Select Focus

V. Project Objectives—Biological

In this section, describe the objective(s) of your project relative to the goal of providing habitat for spring-run Chinook salmon and steelhead. Indicate the species and life stage that are targeted by the project. (It is okay to have more than one species/life stage target).

Target Species: ☒ Spring-Run Chinook Salmon **Population Status Specific to Watershed:** Decreasing

Target Life Stages:

☐ Spawning ☐ Egg Incubation ☐ Summer Rearing ☐ Winter Rearing

☒ Juvenile Emigration ☒ Adult Immigration ☐ Adult Holding

Description of Project Objectives:

The objective is to remove the partial passage impediment and allow free passage of adult and juvenile spring Chinook salmon at all flows. This will allow the adults to access suitable holding and spawning habitat which will

V. Project Objectives—Biological

increase their survival.

Target Species: ☐ Steelhead

Population Status Specific to Watershed: Relative to Historical

Target Life Stages:

☐ Spawning ☐ Egg Incubation ☐ Summer Rearing ☐ Winter Rearing

☐ Juvenile Emigration ☐ Adult Immigration

Description of Project Objectives:

VI. Project Cost

Capital Cost:	It is estimated that the total construction cost will be around $700,000. Due to the remote location, mobilization costs may be high. In addition, finding a suitable borrow pit for bridge approaches may be spendy if material needs to be hauled any distance. Currently, there is no suitable borrow pit identified.
Annual Operation and Maintenance Cost:	
Annual Operation and Maintenance Description:	
Project Lifespan:	50+ years
Project Partners (Funding):	USFWS - AFRP has funded the environmental documentation, permitting, and engineered design - $98,000.
Project Partners (Maintenance):	CDFG

VII. Schedule

Proposed Start:	2010
Expected Time to Completion:	2010, one work season
Expected Time to Realize Environmental Benefits:	immediately
Expected Time to Realize Biological Benefits:	immediately

VIII. Feasibility

Technical Feasibility:	Nothing has been identified to date that would preclude building a bridge.
Technical Challenges:	Remote location, depending on bridge dimensions some road work may need to occur (widening a few curves).
Related Projects:	There is a project downstream that is addressing non-existant juvenile bypasses on 2 currently screened diversions.
Ownership or Permitting Challenges:	Ownership is CDFG, fully supportive of the project.
Conflicts with Cultural, Zoning, or Other Issues:	None identified at this point.

IX. Project Support

Supporting Entities:	USFWS-AFRP, CDFG, NMFS
Cooperating Entities:	CDFG, USFWS, NMFS
Degree of Local Support:	High
Known Opposition:	None

X. Supporting Documents

Please provide a full reference for each citation used to support the information presented in this questionnaire.

Environmental documents, permits, and designs should be done by late summer/early fall. Available upon request.

USFWS. 2008. Internal document of Limiting Factors developed for 10 year CVPIA Implementation Strategy.

Definitions of Limiting Factors for Spring-Run Chinook Salmon and Steelhead

Channel Form

This attribute describes changes to the channel, including incision, aggradation, diking, armoring, and other modifications of the channel adversely affecting spring-run Chinook salmon and steelhead.

Channel Unit Types

Examples of geomorphic features of the channel that form habitat types for spring-run Chinook salmon and steelhead are pools, riffles, glides, and runs. This attribute describes changes in the frequency and size of such features. For example, removal of large wood may reduce the frequency of pools, presence of steps, or retention of gravel for riffles.

Substrate

This attribute describes changes in the composition of the substrate of the stream, including increase in fine sediment and lack of gravel recruitment.

Structure

This attribute describes the loss of structural elements in the stream such as large wood, boulders, undercut banks, and so on. Loss of structure results in a simplification of the channel and influences Channel Form and Channel Unit Types.

Flow

This attribute addresses modification of the flow regime, including decrease in summer low flow, increased "flashiness," and dewatering of the channel as a result of withdrawals.

Temperature

Change in water temperature can be attributable to human actions such as removal of riparian shading. This attribute describes the increase in summer water temperature and the loss of temperature refugia (springs or groundwater) as a result of human actions.

Water Quality

This attribute pertains to the input to the stream of toxins or pollutants that produce adverse impacts on spring-run Chinook salmon or steelhead. This can include chemical pollutants such as fertilizer and pesticides and nutrient sources such as cattle and feedlots.

Passage

This relates to the effect of impediments to adult or juvenile migration of spring-run Chinook salmon or steelhead, including dams, culverts, channel dewatering, and other structural and channel modifications. Please describe the location of the passage impediment and describe the extent of impediment (i.e., a complete or partial blockage to migration).

Riparian/Floodplain

This attribute describes the loss of functionality of the riparian forest/vegetation and the connection of the stream to the floodplain during high water and flooding.

Population Condition Definitions for Section V. Project Objectives—Biological

Increasing

Adult returns of the target species to the watershed have generally been increasing over the last several years; expectations are that the species is displaying characteristics of a rebuilding or healthy population.

Stable

Adult returns of the target species to the watershed show no clear trend over the last several years.

Decreasing

Adult returns of the target species to the watershed are declining over the last several years; the decline in abundance is a cause of concern and characteristic of a potentially unhealthy population.

Intermittent

Adult returns of the target species are occasionally seen in the watershed, but there is no viable or sustained population in the basin.

Extirpated

The population has been eliminated from the watershed although the species was present in the past.

Never Present

The species has never been known to occur in the watershed.

Appendix D3

Questionnaires Received on the Big Chico Creek Action

Questionnaire

for

Information on Potential Projects to Support Spring-Run Chinook Salmon and Steelhead in the Sacramento River Basin for the Habitat Expansion Agreement

DUE: Thursday, April 30, 2009

Send completed questionnaires to hea@water.ca.gov

I. Contact Information

Name:	Tracy McReynolds
Organization:	CA. Dept. of Fish and Game
Address:	2545 Zanella Wy. Suite F
City, State, Zip Code:	Chico, CA 95928
Phone Number:	(530) 895-5111
Email Address:	tmcreynolds@dfg.ca.gov

II. Project Description

Project Name:	Iron Canyon Fish Ladder Rehabilitation Project
Reference No. or New:	NS-13
Project Location:	The Iron Canyon Fish Ladder is located in Iron Canyon, Upper Bidwell Park, on Big Chico Creek, northeast of Chico, CA, in Butte County. The site is located near the Salmon Hole and Parking Lot P areas of Upper Bidwell Park, accessible from Upper Park Road, a gravel road that roughly parallels the creek, in T22N, R2E, and undesignated section of Arroyo Chico Land Grant.

Project Description:

A massive landslide in the early 1900's blocked spring-run Chinook and steelhead access to holding and spawning habitat above Iron Canyon. In 1958 the California Department of Fish and Game (DFG) constructed the Iron Canyon Fish Ladder to provide access through the blocked area to the nine miles of habitat above Iron Canyon. The ladder is now 50 years old and damage has made fish passage at low flows extremely difficult or impossible.

II. Project Description

The proposed project would repair existing weirs, expand and modify existing weirs, and install 6 new weirs at the Iron Canyon Fish Ladder (CSU, Chico Research Foundation 2008). The specific construction involves:
• Pool deepening, at minimum of 0.1 feet to 2.1 feet. Excavation of pool sidewalls will be necessary, with large boulder-sized blocks potentially requiring partial or complete removal. Jack-hammer and/or drilling may be necessary for the large block removal. Excavated material does not require removal from the site and may be disposed of in adjacent, non-fishway pools.
• Partial demolition of 18 existing weirs (Weirs 1 through 6, 6B, and 7 through 17). These weirs will then be encased in new reinforced concrete.
• At the contractor's discretion, existing weirs may also be entirely demolished and replaced with new weir design, rather than encased.
• Installation of 6 new weirs (Weirs 1B, 5B, 7B, 8B, 8C, and 11B) constructed with reinforced concrete.
• Installation of fabricated aluminum flashboards into finished weir slots.
The purpose of the project is to improve adult spring-run Chinook and steelhead passage to holding and spawning habitat above Iron Canyon over a broader range of flows.

III. Species Limiting Factors

In this section, describe the limiting factors for spring-run Chinook salmon and steelhead in your watershed. The last page of this questionnaire defines the limiting factors.

Limiting Factors	Description (from back page)	Rank
☐ **Channel Form**		Select Rank
☐ **Channel Unit Types**		Select Rank
☐ **Substrate**		Select Rank
☐ **Structure**		Select Rank
☒ **Flow**	Agricultural diversions in the Valley reach reduce flows impeding both upstream and downstream passage.	High
☒ **Temperature**	Reduced flows in the Valley reach increase water temperatures and can impact juvenile rearing conditions.	High
☐ **Water Quality**		Select Rank
☒ **Passage**	The lower reaches have flood control structures and diversions that impede upstream passage when flow is low.	High
☒ **Riparian/Floodplain**	Flood control measures and land use (agricultural and urban) have degraded riperian habitats in the lower reaches	High

Source Documents:

Big Chico Creek Watershed Alliance. Big Chico Creek Existing Conditions Report. Publication date unknown.

Available from http://www.bigchicocreek.org.

Additional Notes:

IV. Project Objectives—Environmental

In this section, describe how your project will affect one or more of the limiting factors for spring-run Chinook salmon or steelhead described above.

Limiting Factor	Description and Objective	Focus
☐ **Channel Form**		Select Focus
☐ **Channel Unit Types**		Select Focus
☐ **Substrate**		Select Focus
☐ **Structure**		Select Focus
☐ **Flow**		Select Focus
☐ **Temperature**		Select Focus
☐ **Water Quality**		Select Focus
☒ **Passage**	The modification will allow the Iron Canyon Fish Ladder to function effectively at flows >= 100cfs. The objective is to improve flow through the fish ladder to facilitate the upstream passage of spring-run Chinook and steelhead over a broader range of flows (HDR and SAGE 2006).	Primary
☐ **Riparian/Floodplain**		Select Focus

V. Project Objectives—Biological

In this section, describe the objective(s) of your project relative to the goal of providing habitat for spring-run Chinook salmon and steelhead. Indicate the species and life stage that are targeted by the project. (It is okay to have more than one species/life stage target).

Target Species: ☒ Spring-Run Chinook Salmon **Population Status Specific to Watershed:** Relative to Historical

Target Life Stages:

☒ Spawning ☐ Egg Incubation ☒ Summer Rearing ☒ Winter Rearing

☐ Juvenile Emigration ☒ Adult Immigration ☒ Adult Holding

Description of Project Objectives:

In recent years, the estimated escapement of spring-run Chinook has been less than 200 however past estimates by DFG suggest that Big Chico Creek could support 1000 spring-run Chinook. Repairing the fish ladder would improve spring-run Chinook access to the existing habitat over a broader range of flows thereby increasing escapement in more years. Therefore, one purpose of this project is to increase escapement of spring-run Chinook in Big Chico Creek by improving upstream passage to summer holding, spawning and rearing habitat.

V. Project Objectives—Biological

Target Species: ☒ Steelhead

Population Status Specific to Watershed: Relative to Historical

Target Life Stages:

☒ Spawning ☐ Egg Incubation ☒ Summer Rearing ☒ Winter Rearing

☐ Juvenile Emigration ☒ Adult Immigration

Description of Project Objectives:

Steelhead escapement to Big Chico Creek is currently unknown but historically steelhead were observed in Big Chico Creek. Improvements to the fish ladder would improve access to spawning and juvenile rearing habitat. Therefore another purpose of this project is to increase escapement of steelhead in Big Chico Creek by improving upstream passage to spawning and rearing habitat.

VI. Project Cost

Capital Cost:	$1,727,151 (HDR 2007)
Annual Operation and Maintenance Cost:	Unknown
Annual Operation and Maintenance Description:	Removing accumulated debris and sediment from pools, installing/uninstalling flashboards, and monitoring movement or deterioration (HDR and SAGE 2006).
Project Lifespan:	The estimated lifespan of the ladder is 50 years (HDR and SAGE 2006).
Project Partners (Funding):	USFWS-AFRP (design and environmental compliance).
Project Partners (Maintenance):	DFG (for basic O&M only).

VII. Schedule

Proposed Start:	Once permits and funding are secured (possibly June 2010).
Expected Time to Completion:	One work season (June-September)
Expected Time to Realize Environmental Benefits:	Immediate
Expected Time to Realize Biological Benefits:	Immediate

VIII. Feasibility

Technical Feasibility:	An evaluation of Iron Canyon for the USFWS was conducted in 2006. Based on the results there was nothing identified geologically, seismically, structurally, or hydraulically to preclude construction of the ladder (HDR and SAGE 2006).
Technical Challenges:	The work site is located in a steep-walled canyon so site access poses a challenge. There is also a low to moderate risk of a block topple or slide and/or compression failure of sections of the canyon walls. These challenges were addressed in the 2006 evaluation of Iron Canyon.
Related Projects:	There are numerous restoration project on-going in Big Chico Creek to address passage issues with agricultural diversions and flood control stuctures in the lower portion of the watershed. In addition, a portion of the habitat upstream of Iron Canyon is protected by the Big Chico Creek Ecological Reserve owned by the California State University, Chico Research Foundation.
Ownership or Permitting Challenges:	The property is owned by the City of Chico. The City of Chico intends to adopt a Mitigated Negative Declaration for the project. No permitting challenges are identified at this time.
Conflicts with Cultural, Zoning, or Other Issues:	None identified at this time. There are some culutral concerns with cumulative impacts of projects within Big Chico Creek that are expected to be resolved.

IX. Project Support

Supporting Entities:	Big Chico Creek Watershed Alliance (BCCWA) and CSU Chico Research Foundation.
Cooperating Entities:	USFWS, DFG, and City of Chico.
Degree of Local Support:	High at this time.
Known Opposition:	None identified at this time.

X. Supporting Documents

Please provide a full reference for each citation used to support the information presented in this questionnaire.

CSU, Chico Research Foundation (2008). Iron Canyon Fish Ladder Rehabilitation Initial study/Mitigated Negative Declaration. SCH No. Pending. Prepared for CSU, Chico Research Foundation, USFWS, and City of Chico. August 4, 2008. Chico, CA.

HDR (2007). USFWS - Iron Canyon Fish Ladder Project Construction Documents Project Manual. Prepared for USFWS. June 2007. Folsom, CA.

HDR and SAGE (2006). Evaluation of Iron Canyon for Proposed Fish Ladder Structure Repair and Construction Final Report. Prepared for USFWS Chico, CA. May 2006.

X. Supporting Documents

Definitions of Limiting Factors for Spring-Run Chinook Salmon and Steelhead

Channel Form

This attribute describes changes to the channel, including incision, aggradation, diking, armoring, and other modifications of the channel adversely affecting spring-run Chinook salmon and steelhead.

Channel Unit Types

Examples of geomorphic features of the channel that form habitat types for spring-run Chinook salmon and steelhead are pools, riffles, glides, and runs. This attribute describes changes in the frequency and size of such features. For example, removal of large wood may reduce the frequency of pools, presence of steps, or retention of gravel for riffles.

Substrate

This attribute describes changes in the composition of the substrate of the stream, including increase in fine sediment and lack of gravel recruitment.

Structure

This attribute describes the loss of structural elements in the stream such as large wood, boulders, undercut banks, and so on. Loss of structure results in a simplification of the channel and influences Channel Form and Channel Unit Types.

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Change in water temperature can be attributable to human actions such as removal of riparian shading. This attribute describes the increase in summer water temperature and the loss of temperature refugia (springs or groundwater) as a result of human actions.

Water Quality

This attribute pertains to the input to the stream of toxins or pollutants that produce adverse impacts on spring-run Chinook salmon or steelhead. This can include chemical pollutants such as fertilizer and pesticides and nutrient sources such as cattle and feedlots.

Passage

This relates to the effect of impediments to adult or juvenile migration of spring-run Chinook salmon or steelhead, including dams, culverts, channel dewatering, and other structural and channel modifications. Please describe the location of the passage impediment and describe the extent of impediment (i.e., a complete or partial blockage to migration).

Riparian/Floodplain

This attribute describes the loss of functionality of the riparian forest/vegetation and the connection of the stream to the floodplain during high water and flooding.

Population Condition Definitions for Section V. Project Objectives—Biological

Increasing

Adult returns of the target species to the watershed have generally been increasing over the last several years; expectations are that the species is displaying characteristics of a rebuilding or healthy population.

Stable

Adult returns of the target species to the watershed show no clear trend over the last several years.

Decreasing

Adult returns of the target species to the watershed are declining over the last several years; the decline in abundance is a cause of concern and characteristic of a potentially unhealthy population.

Intermittent

Adult returns of the target species are occasionally seen in the watershed, but there is no viable or sustained population in the basin.

Extirpated

The population has been eliminated from the watershed although the species was present in the past.

Never Present

The species has never been known to occur in the watershed.

Questionnaire

for

Information on Potential Projects to Support Spring-Run Chinook Salmon and Steelhead in the Sacramento River Basin for the Habitat Expansion Agreement

DUE: Thursday, April 30, 2009

Send completed questionnaires to hea@water.ca.gov

I. Contact Information

Name:	Susan Strachan
Organization:	CSU, Chico Research Foundtion
Address:	Bldg 25, CSU Chico
City, State, Zip Code:	Chico, CA 95928-0870
Phone Number:	530-894-1308
Email Address:	sstrachan@csuchico.edu

II. Project Description

Project Name:	Iron Can yon Fish Ladder Rehabilitation
Reference No. or New:	New
Project Location:	Iron Canyo, Big Chico Creek, Chico, Butte County

Project Description:

Rehabilitate existing weirs and install new weirs to provide consistent access to holding and spawning habitat at low to moderate flows.

III. Species Limiting Factors

In this section, describe the limiting factors for spring-run Chinook salmon and steelhead in your watershed. The last page of this questionnaire defines the limiting factors.

Limiting Factors	Description (from back page)	Rank
☐ **Channel Form**		Select Rank
☐ **Channel Unit Types**		Select Rank
☐ **Substrate**		Select Rank
☐ **Structure**		Select Rank
☐ **Flow**		Select Rank
☒ **Temperature**	Temperature below Iron Canyon lethal.	High
☐ **Water Quality**		Select Rank
☒ **Passage**	Iron Canyon boulders obstruct adult passage in low to moderate flow years. Flood control structures can affect adult and juvenile passage.	High
☒ **Riparian/Floodplain**	Urban land use, agricultural land use and flood control modifications have degraded riparian habitat in valley reaches.	Medium

Source Documents:

Big Chico Creek Watershed Alliance, undated.

Additional Notes:

IV. Project Objectives—Environmental

In this section, describe how your project will affect one or more of the limiting factors for spring-run Chinook salmon or steelhead described above.

Limiting Factor	Description and Objective	Focus
☐ **Channel Form**		Select Focus
☐ **Channel Unit Types**		Select Focus
☐ **Substrate**		Select Focus
☐ **Structure**		Select Focus
☐ **Flow**		Select Focus
☐ **Temperature**		Select Focus
☐ **Water Quality**		Select Focus
☒ **Passage**	Project will restore adult passage at low and moderate flows to reach	Primary

IV. Project Objectives—Environmental

holding, spawning and rearing habitat.

☐ **Riparian/Floodplain** Select Focus

V. Project Objectives—Biological

In this section, describe the objective(s) of your project relative to the goal of providing habitat for spring-run Chinook salmon and steelhead. Indicate the species and life stage that are targeted by the project. (It is okay to have more than one species/life stage target).

Target Species: ☒ Spring-Run Chinook Salmon **Population Status Specific to Watershed:** Intermittent

Target Life Stages:

☒ Spawning ☐ Egg Incubation ☒ Summer Rearing ☒ Winter Rearing

☐ Juvenile Emigration ☒ Adult Immigration ☒ Adult Holding

Description of Project Objectives:

The estimated escapement of spring-run Chinook is highly variable, ranging from 0 in low flow years to almost 400 in high flow years. Repairing the fish ladder would improve spring-run Chinook access to the existing habitat over a broader range of flows thereby increasing escapement in more years. Therefore one purpose of this project is to increase escapement of spring-run Chinook in Big Chico Creek by improving upstream passage to summer holding, spawning and rearing habitat.

Target Species: ☒ Steelhead **Population Status Specific to Watershed:** Intermittent

Target Life Stages:

☒ Spawning ☐ Egg Incubation ☒ Summer Rearing ☒ Winter Rearing

☐ Juvenile Emigration ☒ Adult Immigration

Description of Project Objectives:

Steelhead escapement to Big Chico Creek is currently unknown but historically steelhead were observed in Big Chico Creek. Improvements to the fish ladder would improve access to spawning and juvenile rearing habitat. Therefore another purpose of this project is to increase escapement of steelhead in Big Chico Creek by improving upstream passage to spawning and rearing habitat.

VI. Project Cost

Capital Cost: $2,114,218 (HDR, 2007, adjusted for 2010 construction costs, grant administration, public outreach and extended construction period for concrete curing)

Annual Operation and Maintenance Cost: unknown

VI. Project Cost

Annual Operation and Maintenance Description:	Routine operation and maintenance will include inspection, removal of debris, adjustment of flow where possible and small repair such as patching walls where broken or damaged, and other minor repairs necessary to keep fish moving through the ladder (DFG, personal communication)
Project Lifespan:	50 years (HDR and Sage, 2006)
Project Partners (Funding):	USFWS-AFRP (design and environmental compliance)
Project Partners (Maintenance):	DFG (routine operation and maintenance as described above)

VII. Schedule

Proposed Start:	Bid package fall, 2009, award April 2010, mobilize June 1, 2010
Expected Time to Completion:	Complete in channel October 15, 2010, site restoration and contract complete Decemer, 2010
Expected Time to Realize Environmental Benefits:	Spring, 2011
Expected Time to Realize Biological Benefits:	Spring, 2011

VIII. Feasibility

Technical Feasibility:	Project selected by agency technical team as preferred alternative (Department of Water Resources, 2002). An evaluation of Iron Canyon for the USFWS was conducted in 2006. Based on the results there was nothing identified geologically, seismically, structurally, or hydraulically to preclude construction of the ladder (HDR and SAGE, 2006).
Technical Challenges:	The work site is located in a steep-walled canyon so site access poses a challenge. There is also a low to moderate risk of a block topple or slide and/or compression failure of sections of the canyon walls. These challenges were addressed in the 2006 evaluation of Iron Canyon.
Related Projects:	Agricultural pumps were moved from mouth of Big Chico to Sacramento River to protect juvenile outmigration. Inflatable dam installed at 1-Mile on Big Chico Creek that can be adjusted to improve passage for spring run and steelhead. Ecological Reserve established that protects 4,000 acres of watershed and 4.5 miles of spring run stream habitat.
Ownership or Permitting Challenges:	CEQA complete. Permitting underway, expected to be complete by fall, 2009.
Conflicts with Cultural, Zoning, or Other Issues:	Cultural resources survey documented no cultural conflicts. Project is consistent with City of Chico planning documents.

IX. Project Support

Supporting Entities:	City of Chico, CSU, Chico Research Foundation, Big Chico Creek Watershed Alliance
Cooperating Entities:	DFG, USFWS, NMFS
Degree of Local Support:	High
Known Opposition:	None

X. Supporting Documents

Please provide a full reference for each citation used to support the information presented in this questionnaire.

All documents except construction specifications can be found at http://www.bigchicocreek.org/nodes/aboutwatershed/projectsprograms/iron_canyon_fish_ladder.htm

Big Chico Creek Watershed Alliance, undated. Existing Conditions Report. Chico, CA. Undated.

Department of Water Resources (2002). Iron Canyon and Bear Hole Fish Passage Project on Big Chico Creek, Preliminary Engineering Technical Report. Sacramento, CA. April 2002.

HDR (2007). USFWS - Iron Canyon Fish Ladder Project Construction Documents Project Manual. Prepared for USFWS. June 2007. Folsom, CA.

HDR and SAGE (2006). Evaluation of Iron Canyon for Proposed Fish Ladder Structure Repair and Construction Final Report. Prepared for USFWS Chico, CA. May 2006.

Definitions of Limiting Factors for Spring-Run Chinook Salmon and Steelhead

Channel Form

This attribute describes changes to the channel, including incision, aggradation, diking, armoring, and other modifications of the channel adversely affecting spring-run Chinook salmon and steelhead.

Channel Unit Types

Examples of geomorphic features of the channel that form habitat types for spring-run Chinook salmon and steelhead are pools, riffles, glides, and runs. This attribute describes changes in the frequency and size of such features. For example, removal of large wood may reduce the frequency of pools, presence of steps, or retention of gravel for riffles.

Substrate

This attribute describes changes in the composition of the substrate of the stream, including increase in fine sediment and lack of gravel recruitment.

Structure

This attribute describes the loss of structural elements in the stream such as large wood, boulders, undercut banks, and so on. Loss of structure results in a simplification of the channel and influences Channel Form and Channel Unit Types.

Flow

This attribute addresses modification of the flow regime, including decrease in summer low flow, increased "flashiness," and dewatering of the channel as a result of withdrawals.

Temperature

Change in water temperature can be attributable to human actions such as removal of riparian shading. This attribute describes the increase in summer water temperature and the loss of temperature refugia (springs or groundwater) as a result of human actions.

Water Quality

This attribute pertains to the input to the stream of toxins or pollutants that produce adverse impacts on spring-run Chinook salmon or steelhead. This can include chemical pollutants such as fertilizer and pesticides and nutrient sources such as cattle and feedlots.

Passage

This relates to the effect of impediments to adult or juvenile migration of spring-run Chinook salmon or steelhead, including dams, culverts, channel dewatering, and other structural and channel modifications. Please describe the location of the passage impediment and describe the extent of impediment (i.e., a complete or partial blockage to migration).

Riparian/Floodplain

This attribute describes the loss of functionality of the riparian forest/vegetation and the connection of the stream to the floodplain during high water and flooding.

Population Condition Definitions for Section V. Project Objectives—Biological

Increasing

Adult returns of the target species to the watershed have generally been increasing over the last several years; expectations are that the species is displaying characteristics of a rebuilding or healthy population.

Stable

Adult returns of the target species to the watershed show no clear trend over the last several years.

Decreasing

Adult returns of the target species to the watershed are declining over the last several years; the decline in abundance is a cause of concern and characteristic of a potentially unhealthy population.

Intermittent

Adult returns of the target species are occasionally seen in the watershed, but there is no viable or sustained population in the basin.

Extirpated

The population has been eliminated from the watershed although the species was present in the past.

Never Present

The species has never been known to occur in the watershed.

Appendix D4

Questionnaire Received on the Battle Creek Actions

Questionnaire

for

Information on Potential Projects to Support Spring-Run Chinook Salmon and Steelhead in the Sacramento River Basin for the Habitat Expansion Agreement

DUE: Friday, February 13, 2009

Send completed questionnaires to hea@water.ca.gov

I. Contact Information

Name:	Mike Berry
Organization:	California Department of Fish and Game
Address:	601 Locust Street
City, State, Zip Code:	Redding, CA 96001
Phone Number:	530-225-2131
Email Address:	mberry@dfg.ca.gov

II. Project Description

Project Name:	Battle Creek Restoration Project
Reference No. or New:	B-1 and B-2.
Project Location:	Tehama County, approximately 2 miles South of the town of Manton

Project Description:

Financial support of implementation of Phase 1(b) of the Battle Creek Restoration Project. Phase 1(b) includes a new tailrace connector from Inskip powerhouse to Coleman Canal and a water bypass channel near Inskip Powerhouse. This phase potentially includes removal of Coleman Diversion Dam, depending on the timing of the completion of Phase 2. The project also includes financial support of implementation of Phase 2 of the Battle Creek Restoration Project. Phase 2 includes removing Coleman Diversion Dam (if not completed in Phase1(b)), South, Lower Ripley Creek Feeder, and Soap Creek Feeder Diversion Dams; installing screens and ladders on Inskip Diversion Dam; a tailrace connector from South Powerhouse to Inskip Canal and decommisioning South Canal.

III. Species Limiting Factors

In this section, describe the limiting factors for spring-run Chinook salmon and steelhead in your watershed. The last page of this questionnaire defines the limiting factors.

Limiting Factors	Description (from back page)	Rank
☐ **Channel Form**		Select Rank
☐ **Channel Unit Types**		Select Rank
☐ **Substrate**		Select Rank
☐ **Structure**		Select Rank
☒ **Flow**	The flow in South Fork Battle Creek is reduced to 3-5 cubic feet per second (cfs) due to diversions for hydro-power, thus severely limiting habitat for all life stages of spring-run Chinook salmon and steelhead.	Critical
☒ **Temperature**	Because of the reduced flow, water temperatures increase to levels lethal to all life stages of spring-run Chinook salmon and steelhead	High
☐ **Water Quality**		Select Rank
☒ **Passage**	The diversion dams have ladders that are to small or are in poor condition and therefore block spring-run Chinook salmon and steelhead access to approximately 16.3 miles of prime habitat.	Critical
☐ **Riparian/Floodplain**		Select Rank

Source Documents:

Battle Creek Restoration Project EIS/EIR (2005), Battle Creek Salmon and Steelhead Restoration Plan (1999).

Additional Notes:

IV. Project Objectives—Environmental

In this section, describe how your project will affect one or more of the limiting factors for spring-run Chinook salmon or steelhead described above.

Limiting Factor	Description and Objective	Focus
☐ **Channel Form**		Select Focus
☐ **Channel Unit Types**		Select Focus
☐ **Substrate**		Select Focus
☐ **Structure**		Select Focus
☒ **Flow**	When the project is completed flow will be increased downstream of Inskip Diversion Dam from the current 3-5 cfs up to 35-40 cfs. Upstream of Inskip Diversion Dam the flows will increase to natural	Primary

IV. Project Objectives—Environmental

	flows because South Diversion Dam will have been removed.	
☒ **Temperature**	The increased flow will lower the temperatures in Battle Creek to levels capable of supporting all life stages of spring-run Chinook salmon and steelhead, including incubation of eggs.	Primary
☐ **Water Quality**		Select Focus
☒ **Passage**	Removal of two dams and a new fish ladder at Inskip Diversion Dam will allow access to 16.3 miles of prime spring-run Chinook and steelhead habitat that has not been used since the early 1900's when the hydro-electric projects were first built. Construction of a State and federally approved fish screen will allow safe passage of emmigrating juveniles passed the diversion canal.	Primary
☒ **Riparian/Floodplain**	The increased flow and additional nutrients from decaying salmon carcasses will likely result in healthier riparian forest/vegetation.	Secondary

V. Project Objectives—Biological

In this section, describe the objective(s) of your project relative to the goal of providing habitat for spring-run Chinook salmon and steelhead. Indicate the species and life stage that are targeted by the project. (It is okay to have more than one species/life stage target).

Target Species: ☒ Spring-Run Chinook Salmon **Population Status Specific to Watershed:** Extirpated

Target Life Stages:

☒ Spawning ☒ Egg Incubation ☒ Summer Rearing ☒ Winter Rearing

☒ Juvenile Emigration ☒ Adult Immigration ☒ Adult Holding

Description of Project Objectives:

In the early 1900's several dams were built on Battle Creek as part of a hydro-electric power production project. The dams on South Fork Battle Creek diverted a majority of the water out of this tributary and blocked passage of adult spring-run Chinook salmon. Completing Phase 1(b) and Phase 2 of the project will restore water flow, temperature, and spring-run Chinook salmon access to16.3 miles of prime historic spring-run Chinook salmon habitat. Additionally the project will restore optimum water temperatures for egg incubation, juvenile rearing, and outmigrating smolts while screening the diversion will prevent emegrating juveniles from being drawn into the canal.

Target Species: ☒ Steelhead **Population Status Specific to Watershed:** Intermittent

Target Life Stages:

☒ Spawning ☒ Egg Incubation ☒ Summer Rearing ☒ Winter Rearing

☒ Juvenile Emigration ☒ Adult Immigration

Description of Project Objectives:

[Same as Above for Spring-Run Chinook Salmon]

VI. Project Cost

Capital Cost:	Phase 1(b) cost estimate is $26 million, Phase 2 cost estimate is $47 million, we are recommending approximately $30 million of HEA money that will be matched with other funds.
Annual Operation and Maintenance Cost:	Not estimated
Annual Operation and Maintenance Description:	Not estimated
Project Lifespan:	Perpetuity
Project Partners (Funding):	Possibly California Department of Fish and Game (CDFG), California Wildlife Conservation Board (WCB), California Department of Water Resources (DWR), Pacific Gas and Electric Company (PG&E), and/or Bureau of Reclamation (Reclamation).
Project Partners (Maintenance):	PG&E will own and maintain all of the improvements and related hydro-power facilities, and have agreed to maintain them in working order.

VII. Schedule

Proposed Start:	Summer 2010
Expected Time to Completion:	2-4 years
Expected Time to Realize Environmental Benefits:	Immediately after completion.
Expected Time to Realize Biological Benefits:	First winter and spring after completion, full benefit after a few generations of returning Chinook salmon and steelhead. Spring-run Chinook salmon and steelhead are present in the drainage downstream of the dam, and are expected to occupy the newly opened habitat during their first adult migration event after completion.

VIII. Feasibility

Technical Feasibility:	This project is very feasable, the feasability studies are complete, engineering and design is complete and the various environmental documents are complete.
Technical Challenges:	None that have not been identified and adequately addressed.
Related Projects:	North Fork Battle Creek restoration is scheduled to start in the Summer of 2009 (Phase 1(a)) and will provide access and suitable habitat for spring-run Chinook salmon and steelhead to 11 miles of North Fork Battle Creek.
Ownership or Permitting Challenges:	There is one landowner near Inskip Dam that is unhappy with various aspects of the project. PG&E continues to work with them to resolve the issues.

VIII. Feasibility

Conflicts with Cultural, Zoning, or Other Issues:	None known

IX. Project Support

Supporting Entities:	DWR, Regional Water Quality Control Board, State Water Resources Control Board, The Nature Conservancy, Metropolitan Water District, Battle Creek Watershed Conservancy, Nor-Cal Fishing Guides and Sportsman Assn., U.S. Forest Service, Lassen National Forest
Cooperating Entities:	CDFG, PG&E, Reclamation, U.S. Fish and Wildlife Service, NOAA Fisheries.
Degree of Local Support:	High
Known Opposition:	Oasis Springs Lodge

X. Supporting Documents

Please provide a full reference for each citation used to support the information presented in this questionnaire.

Kier Associates. 1999. Battle Creek Salmon and Steelhead Restoration Plan. Prepared for the Greater Battle Creek Watershed Working Group. January. Sausalito, CA.

Jones and Stokes. 2005. Battle Creek Salmon and Steelhead Restoration Project Final Environmental Impact Statement/Environmental Report. July. Sacramento, CA.

Definitions of Limiting Factors for Spring-Run Chinook Salmon and Steelhead

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